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WATER SUPPLY, & SANITARY IMPROVEMENT.

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GAS PURIFICATION
BY
OXIDE OF IRON.

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See Advertisement in last week's JOURNAL, page 654.

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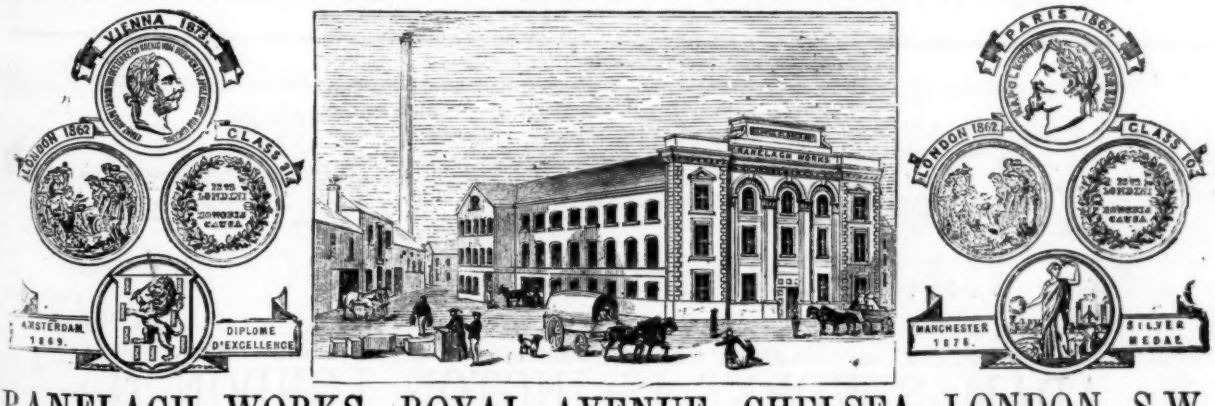

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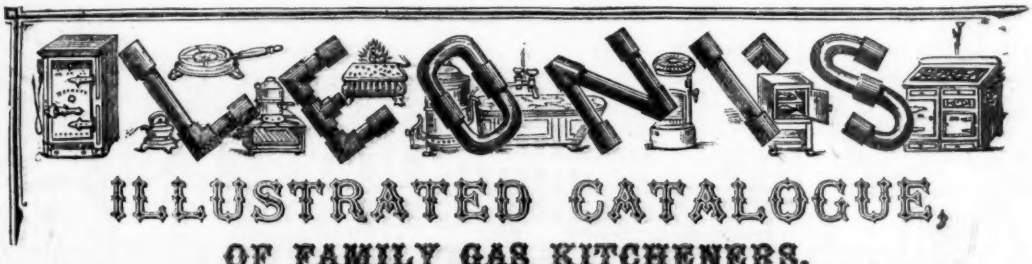

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Samples on application.

MESSRS. SPENCE BROS., LIMITED,

Will be glad to supply the above on the most favourable terms, and to treat, by Purchase or Exchange, for Spent Oxide.

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IMPROVED HYDRAULIC CRANES,

Effecting a great saving in the cost of discharging Coals from Vessels, Barges, &c. Several of these Cranes, with the necessary power, are now being erected at Beckton, Hull, and other Gas-Works.

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Sixteen recently erected at Beckton, applied to Covers 30 feet square.

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Special "REGULUS COCKS" manufactured to stand Acid.

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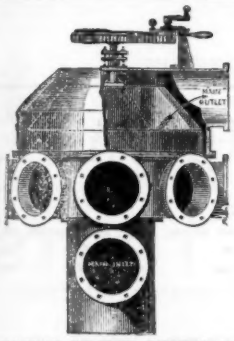
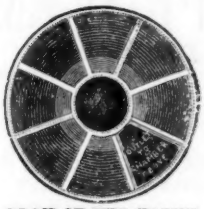
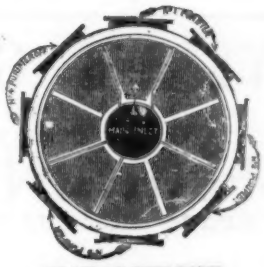
C. & W. WALKERS'
PATENT CENTRE-VALVES.



ELEVATION OF THE CENTRE-VALVE.



PLAN OF THE VALVE.



PLAN OF THE BODY.

These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers on the system of three in action, and one out of action. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A considerable improvement and saving is effected in the cost of the connecting-pipes.

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NEW GAS-WORKS erected complete. Plans and Estimates furnished. MAINS, METERS, SERVICES, LAMPS, &c., adapted for Towns of any size. Gas Companies advised on Improvements, Extensions, and Alterations of Works.

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PURIFIERS, CONDENSERS, SCRUBBERS, GASHOLDERS, ROOFS,

And every description of Gas Machinery.

TENDERS GIVEN FOR WORK FIXED COMPLETE IN ANY PART OF THE KINGDOM.

WEST'S GAS IMPROVEMENT COMPANY,
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ARE NOW PREPARED TO SUPPLY AND ERECT THEIR PATENTED MACHINERY FOR

CHARGING AND DRAWING GAS-RETORTS,
And to enter into arrangements with GAS COMPANIES for its use upon moderate terms of Royalty.

The Patented Machinery has secured the approbation of all Engineers who have visited the MAIDSTONE GAS-WORKS, *where it is in full operation, and may be inspected at any time on application to the Manager.*

The advantages attending its use are—

INCREASED VOLUME OF GAS PER TON.—INCREASED YIELD PER RETORT.—INCREASED BULK OF COKE FOR SALE.—REDUCTION IN LABOUR AND LESS DEPENDENCE ON SKILLED STOKERS.

A Pamphlet containing a description of the Machinery, and Copies of Reports on the working of the same, &c., will be forwarded on application to the MANAGING DIRECTOR, Maidstone. Communications may also be addressed to the Consulting Engineer, R. P. SPICE, Esq., M. Inst. C.E., 21, Parliament Street, London, S.W., or to the Engineer and Analyst, F. W. HARTLEY, Esq., A. Inst. C.E., 55, Millbank Street, London, S.W.

EDWARD COCKEY & SONS,
GAS ENGINEERS, FROME SELWOOD,
MANUFACTURERS OF ALL DESCRIPTIONS OF

APPARATUS CONNECTED WITH GAS-WORKS.
THE ORIGINAL PATENTEES AND MANUFACTURERS OF THE

DRY-FACED VALVES
FOR PURIFIERS, GASHOLDERS, BYE-PASS, AND OTHER ARRANGEMENTS REQUIRING VALVES IN GAS-WORKS.

The Faced Valves, as made by the Patentees, continue to give great satisfaction, and they are being used extensively by many of the best gas engineers of the day.

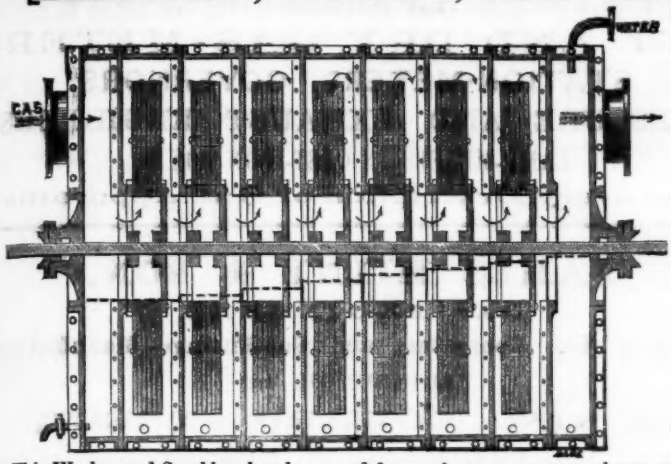
They are more easily repaired than any other kind of Valve in use, and can be re-ground in a few hours without removal, and made perfectly gas-tight.

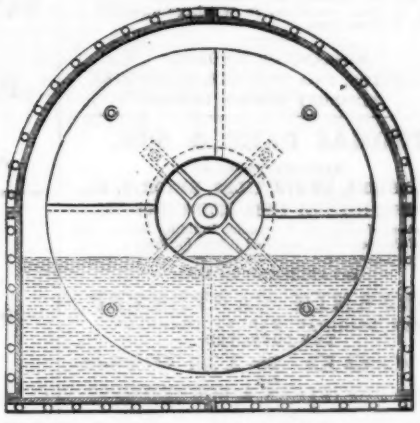
References can be given to many Engineers of high standing, who will testify as to the favour in which they are held.

MANUFACTURERS ALSO OF SUPERIOR WOOD GRIDS FOR PURIFIERS, SCRUBBERS, &c.

THE "STANDARD" WASHER & SCRUBBER.

[KIRKHAM, HULETT, AND CHANDLER'S PATENT.]





This Washer and Scrubber has been used for nearly two years on a large scale at the Works of The Gaslight and Coke Company, Bromley-by-Bow, at which station there are now several in operation and in course of construction. There is also one in use at the Pancras Station, King's Cross, of the same Company, which is purifying 1,500,000 cubic feet of gas per day. At the Gas-Works of the Corporation of Leeds, a large one has been erected, which is giving complete satisfaction. The Special Merits of this Washer are as follows:—

That it is a very effective Condenser, so that it is not absolutely necessary to reduce the temperature of the gas to 60°, or thereabouts, to make the Washer effective. That the distribution of the liquor is made with unerring regularity. That it occupies very small space, so that it can be, at little expense, effectually protected from extreme changes of the weather. That the considerable expense of Coke or Wood, or other Scrubbing Material, is entirely saved, and that the great nuisance and cost of from time to time replacing the Scrubbing Material is avoided. That, by the revolution of the discs, the quantity of water carried up by them, and tending continuously to fall, exposes a very large amount of fresh wetted surface to contact with the gas. That it is particularly adapted for Gas-Works where Sulphate of Ammonia is manufactured. That it is much cheaper than any other Scrubber that will do the same amount of work effectually. That it is the only Washer suitable for purifying Gas from all its impurities by solution. That it works with a minimum of pressure. That it takes out every trace of Ammonia from the Gas in once traversing the machine. That it requires very little outlay for foundations.

The following Testimonials show the opinion of eminent Engineers as to the capabilities of the Washer:—

D. HULETT, Esq. *The Gaslight and Coke Company, Bromley-by-Bow, May 3, 1877.*

Dear Sir,—In answer to your inquiries respecting the results of the working of your Patent Washer, I beg to state that I find it a very efficient machine. I have had it in operation for some time, and passed gas through it continuously at the rate of 100,000 cubic feet per hour, and obtained from it 11 gallons of 10 oz. liquor per ton of coal carbonized—results which appear to me very satisfactory for so small a Washer. It works very smoothly, taking but little power, and giving no pressure. I have it still in operation, and am perfectly satisfied with its working.

I am, dear Sir, yours truly, (Signed) W. B. WRIGHT.

Messrs. KIRKHAM, HULETT, and CHANDLER. *The Leeds Corporation Gas-Works, York Street, Leeds, Dec. 6, 1878.*

Gentlemen,—The Scrubber-Washer erected by you at these works, and which has been in use for six months, has proved to be, so far as we have been able to test it, thoroughly efficient. We are at present making 32,000 feet of gas per hour, and are entirely dependent on this apparatus for the removal of Ammonia, and the **Gas is perfectly free from that impurity in the sixth chamber**, so that four chambers remain to deal with an increasing make of gas. Owing to insufficient condensers, the gas was in the summer admitted to the Scrubber at a temperature of 70°, but was reduced therein to 61°, or that of the atmosphere. The volutes are driven at the rate of four revolutions per minute, and, working at that speed, there is not the slightest difference between the inlet and the outlet pressure. Clean water supplied at the rate of 10 gallons per ton of coal carbonized is converted into liquor of from 10 oz. to 13 oz. strength **in once traversing the vessel.** The apparatus is extremely simple and compact, occupies but little space, and requires no foundation. I shall be surprised if it does not eventually become extremely popular.

I am, Gentlemen, yours faithfully, (Signed) HENRY WOODALL, Engineer.

Messrs. KIRKHAM, HULETT, and CHANDLER. *The Gaslight and Coke Company, York Road, King's Cross, Jan. 14, 1879.*

Gentlemen,—In reply to your inquiry, I am pleased to say, the Washer which was put in action at this station in October last has quite fulfilled my expectations, as it confirms the experiments I made in May last with the smaller machine. Working at four revolutions per minute, **it takes out every particle of Ammonia**, while purifying more Gas than it was intended to do. I enclose particulars of a fortnight's working during our heaviest make, by which you will see that it yields the full quantity and strength of liquor, and works with little pressure. I am therefore quite satisfied with the machine, and trust it may meet with the success it deserves.—I remain, &c. (Signed) JOHN CLARK.

The following Table shows the results of the working of one of these Washers, lately erected to purify 60,000 feet of Gas per Hour, at the St. Pancras Station of The Gaslight and Coke Company:—

1879.	Nos. of the Divisions and Strength of Liquor in each.										Water used per Ton of Coals.	Gas Purified per Hour, Cubic Feet.	Ammonia on Outlet.	Temperature.			Pressures.		Revolutions per Minute.
	1	2	3	4	5	6	7	8	9	10				Inlet.	Outlet.	Atmosphere.	Inlet, Inches.	Outlet, Inches.	
	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.									
January 1	8½	6¾	5	3½	2½	1½	¾	¼	0	0	10 Gallons.	52,000	Nil.	77°	73°	48°	24	23	7½
„ 2	8½	7	6	4½	3½	2½	1½	¾	¼	0	10 „	57,000	Nil.	73°	66°	32°	21½	20½	4
„ 3	9¼	8	6	3½	3	2½	1½	¾	¼	0	10 „	60,000	Nil.	75°	68°	40°	23½	22	4
„ 4	9¼	7¾	6¼	4¼	3¼	2¼	1¼	¾	¼	0	10 „	65,000	Nil.	74°	68°	33°	24	22½	5
„ 5	9½	7	6	4	3	2½	1¼	1	¼	0	10 „	34,000	Nil.	77°	68°	35°	14½	14	5
„ 6	9¼	7½	6½	4½	3	2¼	1½	1	¼	0	10 „	63,000	Nil.	72°	66°	27°	24	22½	4½
„ 7	11	9	7	5½	3½	3	1½	1½	¼	0	10 „	59,000	Nil.	74°	66°	31°	25	23½	5
„ 8	9½	7½	6	4½	3	2	1	¾	¼	0	10 „	78,000	Nil.	73°	61°	31°	28	26½	4½
„ 9	11	9	7	5	3½	2½	1½	1	¼	0	10 „	82,000	Nil.	74°	67°	33°	27½	25¾	5
„ 10	10½	8½	6½	5	3½	2½	1½	1	¼	0	10 „	66,000	Nil.	76°	64°	28°	28½	27	5
„ 11	12½	10	7½	5½	4½	3½	1½	1½	½	0	10 „	61,000	Nil.	73°	64°	27°	26½	25½	5
„ 12	11	8½	6½	—	—	—	1½	¾	¼	0	10 „	39,000	Nil.	74°	64°	27°	26½	25½	5
„ 13	13	10½	8½	6	4½	3½	2	1½	½	0	10 „	78,000	Nil.	73°	65°	42°	28	26	5

Messrs. KIRKHAM, HULETT, and CHANDLER. *Corporation of Birmingham, Gas Department, Saltley Works, May 23, 1879.*

Gentlemen,—I beg to enclose you a copy of the results of the tests which, by the kind permission of the Engineer, Mr. Clark, I made on the 6th of March last, of the working of one of your "Standard" Washers and Scrubbers at the St. Pancras Station of The Gaslight and Coke Company, and I am of opinion that, for an apparatus occupying so small a space, they are exceedingly satisfactory.—Yours truly, HENRY HACK, Engineer.

Working Results obtained from KIRKHAM, HULETT, *and* CHANDLER'S *Patent "Standard" Washer and Scrubber at the St. Pancras Station of The Gaslight and Coke Company, London, March 6, 1879.*

Gas passing per Hour, Cubic Feet.	—	Impurities in Gas per 100 Cubic Feet.			Temperature.		Pressure in Inches.	Revolution of Apparatus per Minute.	—	No. of Divisions and Strength of Liquor.										Water Used during Experiment. Gallons.
		SH_2	CO_2.	Grains. NH_3.	Washer.	Air.				—	—	—	—	—	—	—	—	—	—	
64,000	Inlet	2·00	2·00	158·8	72	57	21	4½	Twaddel deg. at 60°	5·3	4·9	2·85	2·35	1·7	1·03	0·6	0·3	0·15	0·1	63
	Outlet	1·50	1·50	0·8	68	57	20		Acid, ounces.	11·0	8·4	6·3	4·5	2·7	1·7	1·3	0·7	0·3	—	

WASHER-SCRUBBERS OF THIS PATENT ARE IN COURSE OF CONSTRUCTION FOR BECKTON, BRADFORD, GREENWICH, WOOLWICH, AND SEVERAL OTHER GAS-WORKS.

For further particulars and testimonials, address

Messrs. KIRKHAM & HERSEY, GAS ENGINEERS, 21, ABINGDON STREET, WESTMINSTER.

C. & W. WALKER'S
WOOD PURIFIER SIEVES,

Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

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FINSBURY CIRCUS, LONDON.

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Also Makers of all kinds of Common Building Bricks, and of Pressed White and Red Bricks for Facing.

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BENJAMIN CARPENTER,
THE ORIGINAL MANUFACTURER OF THE IMPROVED
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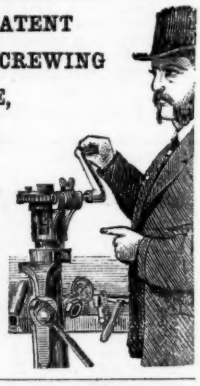
Are the Sole Manufacturers of
Archer's Patent Hoists,
ALSO OF
Archer's Patent Stone Breaker,
AND OF
Archer's Patent Ore Crusher & Pulveriser,
The last-named Machine (without the Pulveriser) makes the best and most durable Coke Breaker.

JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
WENLOCK IRON WHARF, 21 & 22, WHARF ROAD, CITY ROAD, LONDON, N.,
Manufacture and keep in stock at their works (also a large stock in London) PIPES and CONNECTIONS 1½ to 48 inches in diameter; and make to order Retorts, Purifiers, and Tanks, with or without planed joints, Columns, Girders, Special Castings, required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Syphons and Covers are joint-faced if required, doing away with millboard and iron boring, or Syphons made without Covers, a socket being cast on and fitted with a small plug about 6 inches in diameter with lead joint. In either way preventing leakage.

GRIRDROD'S PATENT
PORTABLE PIPE SCREWING MACHINE,



For 1 in., 1¼ in., 1½ in., and 2 in. Gas Threads, complete £7 10s.
In use at the chief gas-works, and giving great satisfaction.
For other useful goods, see Bailey's "Illustrated Inventions," post free 3s. 6d.; gratis to ledger customers.
W. H. BAILEY & CO.,
Brassfounders, Gauge njector and Tool Makers,
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Gold Medal Awarded, Paris Exhibition, 1878.

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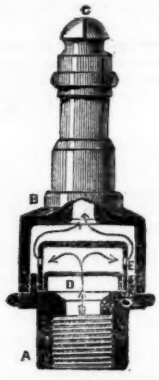

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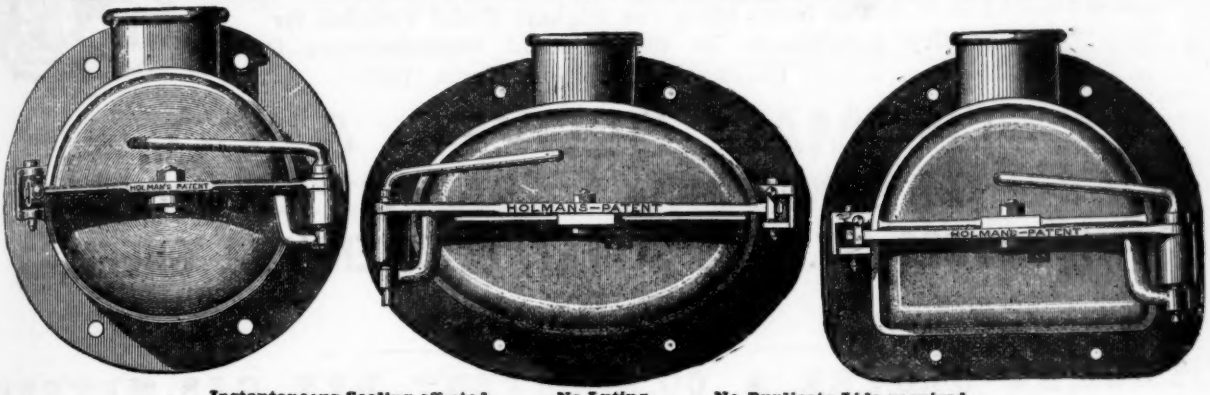
WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,

Anti-Friction Catches, and New Self-Adjusting Cross-Bars.



Instantaneous Sealing effected. No Luting. No Duplicate Lids required.

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Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested, being now in use in nearly all the principal Gas-Works in London and the Provinces.

T. B. and H. are now making the "Morton's Self-Sealing Lid" of the SAME FORM OR SECTION AS THE RETORT (see Illustrations above), as well as bringing the Mouthpiece from the D or Oval at back to Circular in front, as heretofore.

D and Oval Morton's Lids are working satisfactorily both in this country, on the Continent, and in the United States of America. Among others they have been adopted by the following Gas-Works:—

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And also in the Gas-Works at Richmond, Maidstone, Gloucester, Glasgow, Portsea, Roubaix (France), The Hague (Holland).

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In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at an convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.

These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hurt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

Yours truly,
(Signed) JOHN JOHNSON.

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Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
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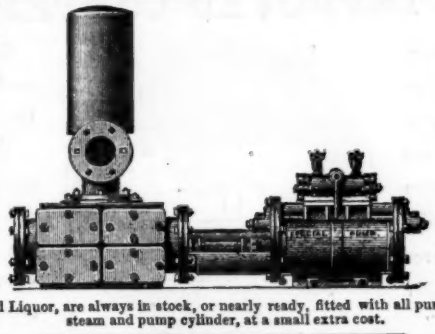
4	2	9	815	18
5*	2½	12	1,250*	21
5*	3	12	1,830*	22 10
4	4	12	3,250	25
6*	4	12	3,250*	30
5	5	12	5,070	32 10
7*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,330*	50
7	7	12	9,750	50
10*	7	12	9,750*	65



In use in a Hundred Gas-Works in the United Kingdom for Pumping Ammoniacal Liquor, Water, or Tar.

Messrs. Burt, Boulton, and Haywood, Manufacturing Chemists, have over FORTY "Special" Steam-Pumps in use at their several large Tar-Works.

Two Hundred Sizes made. Those in Table opposite are the leading Sizes for use in Gas-Works and Chemical Works.

* These Sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance-piece between steam and pump cylinder, at a small extra cost.

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London, 1851. New York. 1853. Paris, 1855. London, 1862.

Dublin, 1865.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

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Paris, 1867.

THOMAS GLOVER & CO.,

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1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
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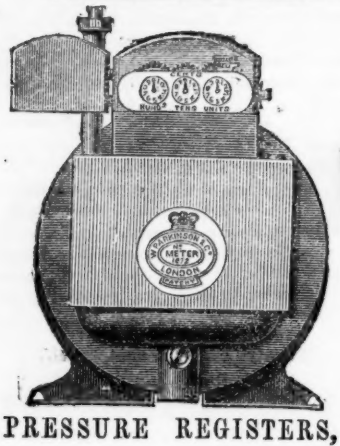
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON AND CO.,



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STATION-METERS & GOVERNORS,

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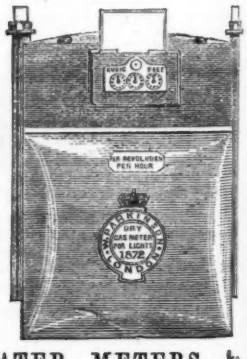

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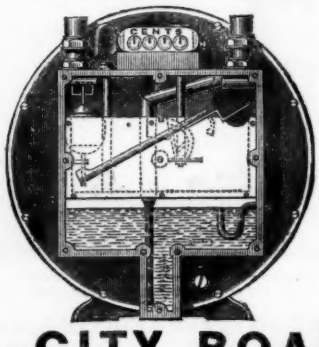
In this Meter, the action of the measuring-drum is reversed. By this arrangement an improvement is effected in the registration at high speeds, which, in many tests, has not varied from the smallest light to three times the capacity of the meter. It works equally well under all pressures. The range of error between the high and low line is much smaller than that allowed by the "Sale of Gas Act."



The Meter has been critically tested, and most favourably reported upon by official Meter Inspectors in London and Birmingham.

W. PARKINSON and CO. have made arrangements for the manufacture of these Meters, both in tin and cast-iron cases, and for the alteration of old ones to this principle, which is confidently recommended as possessing every quality that can be desired by Gas Companies, Corporations, or Private Consumers.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, NOVEMBER 4, 1879.

Circular to Gas Companies.

THE scheme approved by the Board of Trade for the amalgamation of the Surrey Consumers Gas Company with the South Metropolitan Company, was, we are happy to say, duly sanctioned by the Privy Council last Tuesday, and the undertakings are indissolubly joined "for better or for worse." The scheme, as finally settled, differs but little from that which we published some time back, the few alterations made by the Board of Trade being noticed in another column. There is one curious point in connection with this amalgamation, and that is the fact that all the Directors of the Surrey Consumers Company go out of office, and the only representative of the extinct Company on the Board will be Mr. Finlay, the Engineer, whose perfect knowledge of the works of the Surrey Company will prove of the greatest utility to the directorate of the United Company. We shall shortly see another illustration of the happy effects of amalgamation, which it is to be hoped will soon be witnessed on a larger scale. There can be no doubt the United Company have a very prosperous career before them. There is everything in their favour; a rapidly extending business to supply new districts, and large tracts of vacant land which are gradually being covered with houses, so that year by year additions will have to be made to the works to meet the growing wants of their area of supply.

The Town Council of Liverpool are proceeding with the application of the electric light. At the last meeting they authorized their Engineer, Mr. G. F. Deacon, to light by electricity the neighbourhood of St. George's Hall, at a cost not exceeding £600. It was proposed by some enthusiastic members of the Corporation to extend the electrical illumination by placing lights upon the Wellington Monument, St. George's Hall, the London and North-Western Hotel, and the Imperial Hotel; but, after some discussion, in the Council, this proposal was withdrawn. No doubt the Council wish to see the effect of the lights they have placed in the Picton Gallery, and those outside the building, before they embark on a more extended use of the new illuminant.

If any one wishes to become acquainted with the growth of one of our large industrial towns, and see how the manufacture and distribution of coal gas keeps pace when encouraged by private or public enterprise, he will find it in a very interesting account of the progress of gas industry in Rochdale, which we publish in another column. As a matter of course, the undertaking was started by a private Company, in the year 1823, and the Directors seem to have managed their affairs with great skill. The works first constructed were estimated to be equal to the production of 20,000 cubic feet of gas daily. In 1844 the undertaking passed into the hands of the Corporation, having been sold by the Company for the sum of £27,700. From this point, it would appear from the account given that rapid progress was made, and now the works constitute one of the most important undertakings in the country. The original Company started with only eighteen retorts. To-day, so well have the Corporation of Rochdale kept up with the rapid growth of their borough, that the works contain no fewer than 352 retorts. Again, the storeage capacity in 1824 was only about 36,000 cubic feet. It is now 1,600,000 cubic feet. Purifying apparatus has, of course, been added as the manufacturing power of the works was increased, and we all know that, at the present day, purification is most effectively performed at Rochdale. Every other part of the plant necessary for finished gas-works has also been added as required. There are few better indications of the progress of Corporation gas undertakings than the increase of the mortgage debt. Thus we find, in the case of Rochdale, that the debt in 1846 amounted to £27,700, while in 1876 it was no less a sum than £128,529. In the same years the amount of gas made was—in 1846, 27,919,000 cubic feet, while in 1876 the make had increased to 241,315,000 feet. Prices have naturally fallen within the same period of time. Thus in the two years we are comparing—1846 and 1876—the average price in the former was 5s. 4¼d., while in the latter it was only 3s. 9¾d. per thousand feet. Here we may conclude the short notice of the Rochdale gas undertaking, the main facts we have stated being culled from a paper prepared by Mr. T. O. Paterson, the Gas Engineer of the Corporation, for the information of the members of the Rochdale Literary and Scientific Society, who were recently treated to a view of the works, and afforded an explanation of their progress, as above set forth.

In another column is given an analysis of the gas accounts of the Corporation of Burnley, made out in the full, clear, and precise method adopted by the Engineer, Mr. Samuel Petty Leather. In this analysis we have a complete detailed statement of the working of the undertaking, which, it will be seen, reflects great credit on the management. To analyze an analysis is a difficult business, and we shall not attempt the task. All we shall say is that we wish earnestly, that all Engineers of Corporation gas undertakings would publish such a statement as is supplied by Mr. Leather. It cannot, we think, be denied that these accounts are generally published in a form (often contained in a bulky volume) which makes them completely unintelligible to all but skilled accountants, and must, we think, puzzle members of Town Councils, whose duty it is to study them.

The Town Council of Retford have just been presented with a report on the results of the first year's corporate working of their gas undertaking. The profits have been ample, and the Town Council appear to be resolved on making the best use of them—namely, in reducing the price of gas. They promise the very substantial reduction of fivepence per thousand feet at the close of the year, and gas cannot be considered dear in Retford, inasmuch as it is sold at an average price of 3s. 9d. per thousand feet. Another good use which the Council intend to make of their gains will, no doubt, be appreciated by the burgesses. It is intended to place two of Sugg's powerful gas-lamps in the Market Square, in commemoration of the purchase of the works, and the success attending it.

The Corporation of Norwich continue to tease the British Gas Company. The last proposal of a member of the Town Council is to publish the accounts of the Company—that is, the accounts as furnished to the Clerk of the Peace. How far these will be useful in assisting the Council in their designs on the Company we will not attempt to say. It may, as one member of the Council evidently expects, turn out that they will be of very little value in assisting them in determining the actual profits made by the Company, and so

helping them to settle the value of the undertaking. We have, on this occasion, nothing to object to in the proceedings of the Town Council. They have a perfect right to refer the general question of the gas supply of the City to their Parliamentary and Bye-Laws Committee, with a view of ascertaining what, if any, powers they may possess either to light the City themselves or delegate the duty to some body of men other than the British Gaslight Company. The Committee will, we fancy, have no difficulty in coming to a conclusion on this point. They will soon discover that wherever there is a statutory Gas Company in possession, doing their duty to the public, competition is not allowed by law. The only complaint brought against the Company at Norwich is as to the charge made by them for gas there, compared with what they charge at Hull. For this difference the Council can see no reason; but the Company, if they chose, could again, as they have already done on a previous occasion, show good and sufficient cause. Why, however, should they exhibit their cards to an antagonistic Town Council? There is no allegation that the gas supplied to the city is either impure or deficient in illuminating power, and this fact alone would prove an obstacle to a compulsory purchase, if the Town Council should have the temerity to attempt one. It is, of course, perfectly open to them to make such a trial, as no doubt their Parliamentary Committee will tell them; but they should at the same time be told that such ventures rarely succeed. The only thing that can be done in a case like this is for the Town Council to come to an understanding with the Company, and then promote a Bill in Parliament to confirm the agreement.

Many gas consumers in the Metropolis are still dissatisfied with the amount of their bills. It is a delusion with them that, while they believe they have consumed no more, and even less gas than in previous periods, the accounts rendered are much higher. They refuse to accept the explanation which is made to them—namely, that the dulness of the weather, for the greater part of this year, has necessitated a much larger gas consumption, which passed without notice until the bill came in. Then, when the extra consumption has been forgotten, an outcry arises that the Companies are defrauding the public. It is curious at this time to see an old story revived, and to hear a gentleman speak of "attenuated "gas." The idea that Gas Companies could, by some occult process, reduce the illuminating power of their gas, and force it more rapidly through the meters, was, if we remember rightly, first put forward by a notorious gas agitator a good many years ago, and was then thoroughly exploded. Since his day, we have heard but little of what he called "thinned "gas," and now we are astonished to find the same stupid story crop up at the last meeting of the Court of Common Council.

Suggested Exhibition of Gas Apparatus at the Westminster Aquarium.—A correspondent writes us that he thinks an exhibition of gas apparatus, made popular and brought home to the public, would be a great benefit to gas producers and gas machinery manufacturers. He suggests that the exhibition should be held at the Royal Aquarium, Westminster, under the auspices of gas engineers and others directly interested in the making of gas and gas-consuming apparatus. He says there is an annex 160 feet by 100 feet, with more room if desirable, that might be set aside in which to exhibit gas cooking in all its branches, gas-engines, and all the different modes of gas lighting, test burners, &c. He would propose, in order to bring home the advantage of cooking by gas to those who are now so prejudiced against it, to give them refreshments—chops, &c.—cooked by gas before their eyes, which could easily be managed and be made remunerative. The only expense to be met would be for medals to be given as prizes in every department; and, being a proprietor of gas-works himself, our correspondent says, if anything is done in the matter, he would be willing to subscribe towards the exhibition.

Midland Association of Gas Managers.—In our report of the proceedings of this Association, as given in last week's Journal, the words "by gradual condensation," in the eighth line of Mr. Tindall's speech, p. 670, should be transposed, so that the sentence in which they occur will read thus:—He believed that if gas was taken off the hydraulic main, and rapidly condensed, it lost some of the vapour of those lighter oils which, by gradual condensation, would otherwise have been carried forward with the gas.

The Fuel of the Future.—We hear that Mr. T. F. Rowland, of the Continental Iron-Works, Greenpoint, New York, whose system of manufacturing water gas has for a long time past been employed by the Municipal Gaslight Company of New York, has recently completed the erection of some benches of retorts at this Company's works, to be heated by the water gas before it is carburetted. In place of the ordinary grate bars, there are fixed in the furnaces pipes perforated with holes, and arranged as a kind of gridiron. The furnace chambers are then loosely filled with lumps of fire-brick, in order to form reservoirs for the heat generated by the ignition of the water gas. The result is said to be a great success. Formerly a charge of 3800 lbs. of coke was employed in the two furnaces of a through bench of six retorts; now 42,000 feet of the water gas are used, with the result of obtaining better and much more even heats. As it requires the above-mentioned amount of coke in the gasogene to produce 80,000 cubic feet of gas, there is a gain of nearly half the gas, besides the lessened labour and wear and tear. In connection with this matter we may state that, besides the alteration of the works of the New York Gaslight Company so as to manufacture water gas according to his invention, which we last July announced had been agreed upon, Mr. Rowland is engaged in the construction of works for a new Company in Brooklyn, and for the Gas Company at Yonkers.

Water and Sanitary Notes.

The attack on the Metropolitan Water Companies is just now being pushed with something like vigour; but, practically, the agitation is confined to comparatively a few. Great efforts have recently been made to induce the Corporation of the City of London to indulge in the Quixotic enterprise of promoting, in the next session of Parliament, a Bill to amend the laws relating to the Metropolitan Water Supply, and to require a constant service of pure and wholesome water at a high pressure, as well as a reduction of the water-rates, and these to be assessed upon a different basis to that which now obtains. All this, and much more, was urged upon the Court of Common Council last Thursday, by a deputation from the meeting held at Cardinal Manning's private residence. The bait, however, did not take, and after a long discussion the Council resolved, on the motion of Mr. Bontems—"That it be referred to the Gas and Water Com-"mittee to confer with Her Majesty's Government as to the "propriety and possibility of taking steps by which the "undertakings of the various Water Companies might be "acquired for the benefit of the Metropolis, and to report "thereon forthwith." This was a harmless proceeding compared with that which some endeavoured to persuade the Corporation to adopt. What the Gas and Water Committee will understand by "forthwith," we cannot guess. They have had references on the Metropolitan Water Question before them for years, and have never made any reports, and now they have another thrown upon their hands, with a peremptory order to report "forthwith."

What will come of the conference with the Government on the subject of the Metropolitan Water Supply, should it ever be held, is very clear. The Home Secretary has pledged himself to Parliament to deal with the question in the next session, and he can only repeat to the Gas and Water Committee of the City Corporation the assurance he gave to Parliament. But what the Committee would like to know is the direction in which Mr. Cross intends to move. Will he recommend the Government to buy up the Companies, and administer them under Imperial control? or will he simply constitute a Commission which will take the water supply out of the hands of the Companies, and direct their affairs for what is called the public benefit of the Metropolis? and, in this latter case, how and by what means, and at what rate, are the Companies to be remunerated for the capital they have laid out?

It is by no means an easy task Mr. Cross has set himself, or perhaps we ought to say has had forced upon him. He will find the Metropolitan Water Question a very hard nut to crack. We venture to affirm that for any scheme to be successful it must receive the assent of the Companies themselves, whose interests are primarily concerned. Most likely since August last, when the Home Secretary gave his pledge, he has privately been in communication with the Companies, with the object of learning their views. If so, he will probably have found that, for a liberal consideration, the Companies would have no objection either to part with their undertakings, or surrender their control over them. But to anything like confiscation such determined opposition would be raised, that even the present Government could perhaps make no head against it. We have repeatedly said, and it is perfectly true, the Metropolitan Water Companies are very strong in both Houses of Parliament, and their supporters would show well in a division list. There are some who fancy that Mr. Cross may be meditating a sweeping change in the Municipal arrangements of the whole Metropolis, as a preliminary step to dealing with the question of the water supply. We hope this may be true, for without it it would be difficult to constitute a Commission to assume the management of the water undertakings. Our present Municipal bodies, it is certain, are not in a position to be entrusted with the control of water affairs, and with the vast powers of local taxation which it would involve. Their limits are not conterminous with the vast area made up of the combined districts of the Water Companies, and if this is held to be a fatal objection, as Mr. Cross made it, to handing over the undertakings to the Metropolitan Board of Works, with how much greater force will that objection apply to the Corporation of the City of London. But we may leave off speculating, and wait for the result of the proposed conference with the Home Secretary.

A clique in Bermondsey have recently held an indignation meeting to protest against what they call the extravagant rates of the Southwark and Vauxhall Water Company, and to demand at the same time a change and alteration in the law which at present makes the water-rate a charge based on the

annual value of the house supplied. The meeting, we have said, was held in Bermondsey, and, no doubt, the bulk of the audience who attended were inhabitants of that neighbourhood; but, of course, no meeting called to abuse Water Company could be complete without the presence of the indefatigable Mr. Beal, and the newly-fledged agitator, Mr. Watherston. Accordingly, these two gentlemen appeared on the platform, and denounced what they called the "oppressive behaviour of the "purveyors of that necessary of life, water." One speaker made a suggestion, which a little more knowledge and reflection would have shown him was at present impossible to be carried out. He wished water to be charged for like gas, according to the quantity consumed. Now, setting aside the fact that there is not yet a meter invented which is adapted for the use of small consumers of water, we may repeat what has here been said before, that, supposing the quantity consumed was alone charged for, it would constitute the greatest encouragement that could possibly be devised to habits of uncleanliness. At the present time, it may be asserted that the supply is practically unlimited; but, stinginess is so common a vice that one may feel assured that as little as possible would be employed by a large number of the population if water were charged for according to the quantity supplied. It would be used in pints where it is now used in gallons. On this ground alone we would deprecate the general adoption of meters. The present rates may appear high, and in some cases possibly they are so; but we do not see a way to make any change in the method of levying them. We rather think the Bermondsey meeting threatened a deputation to the Court of Common Council; but probably after what transpired at Guildhall last Thursday, they will decide to stay away.

In a few days we shall learn the result of the poll of the ratepayers of Liverpool on the Vyrnwy scheme. In the meantime, we regret to find some disorderly scenes occurring in the Town Council. With the best of intentions, Mr. Wilson, the Chairman of the Water Committee, apparently on his own responsibility, sent out a circular to the ratepayers, setting forth the advantages of the Vyrnwy scheme over others which have been proposed. This action has given much offence to some members of the Council, who, at the last meeting, made a "scene." We are sorry to notice that politics have become mixed up with the water supply question, Liberal members taking one side and Conservatives the other. It is always to be lamented when politics are introduced into Municipal matters, but if it is to be understood that a question like that of the selection of a water scheme is to be influenced by party considerations, the ratepayers of Liverpool may have less difficulty than they otherwise would have in making up their minds.

When the Stockton and Middlesbrough Water Act, 1876, was passed, which, among other things, was intended to compel the Corporations to discontinue the supply of water obtained from the River Tees, and to construct new works with the view of furnishing "unpolluted" water, we ventured to express an opinion, that so long as the river supply could be decently maintained, the Corporations would make no efforts to find a purer source. It has turned out as we expected, and it is now proposed that the Corporation should apply for a Provisional Order to extend the time for the completion of new works. We can hardly feel surprised at this at the present time, when trade in the district is so fearfully depressed. Still, the Joint Water Board may as well look forward, for better times are certainly coming; and although they have power to take from the Tees more dirty water than they at present require, they should at once set themselves heartily to work, and proceed as quickly as they can with the proposed new works.

If any one wishes to see a town in a bad sanitary condition, he may go to Yeadon, in Yorkshire, where he will find nearly every unsanitary abomination in existence. An outbreak of scarlatina recently brought down an Inspector from the Local Government Board, who, in his report just issued, candidly admits his inability to account for the origin of the outbreak, but has no difficulty in explaining the manner in which the disease has been distributed. Yeadon is supplied with water by a private Company, against whose arrangements grave accusations are made. In the first place, the Company obtain their supply from wells notoriously polluted, and also from the surface of fields, &c., which have been manured with night-soil, and in which cattle are allowed to graze. The sanitary condition of the houses, too, appears to be as bad as possible; but we need not pursue the unsavoury subject further. In concluding his report, Mr. Spear, the Inspector, recommends that the Local Authority should, in effect, take the supply of water out of the hands of the Company, and provide a better one; and, above all, one pure at its source. But why should not the Water Company themselves at once set to work and amend their ways, by seeking a new source in place of the one which it was proved beyond doubt was totally unfit for use, as well as by providing better means of collection and distribution?

THE INSPECTION OF COAL MINES.

The history of coal mines inspection, the demand for which has been intensified by the occasional accidents from explosions in coal mines, dates only from the year 1842, when Lord Shaftesbury, then Lord Ashley, introduced his measure prohibiting the employment of women and children underground. From that time to the present it has continually occupied the attention of Parliament, and questions connected with it are still under consideration. There can be no doubt that the continued profitable working of our mines, and the production of the vast quantity of coal needed for the purposes of heating, lighting, and exportation is in some measure dependent on such inspection being carried on with efficiency and judgment. There is always a tendency, especially among small colliery owners, of whom the number is considerable, to follow any method that will give early and immediate profit, to avoid the cost of systematic mining, and to employ labour of the cheapest kind and at the lowest wage, without regard to the future of the mine, or the working of seams which are now unprofitable. For this reason a history, such as that just published by Mr. Boyd,* has great interest and value to all consumers of coal, as it points out the methods that have been introduced to check this tendency, and to utilize, as far as possible, the valuable stores that remain. It contains a large amount of useful and interesting information, and should be in the hands not only of all coalowners, but of all great coal consumers.

The fiery or dangerous seams are those which yield the most valuable coal to the gas manufacturer, and which need the greatest care in working. The production of coal, which in 1850 but little exceeded 50 millions of tons per annum, is now approaching 130 millions; or, in other words, will have nearly trebled in 30 years; but the number of accidents from explosion, which in 1870 averaged 56½ per annum, was reduced in 1875 to 41. This result of inspection is too favourable to pass unnoticed.

It is true that the inspection of coal mines is not a subject directly affecting the question of gas supply; but, as bearing on the quantity, quality, and cost of mineral fuel, it is too important indirectly not to justify a brief notice of this useful record of its history in our own country.

Gas Agitation at Norwich.—At the meeting of the Norwich Town Council on Tuesday, the 21st ult., it was moved, and after a short discussion agreed to with only one dissentient—"That the accounts of the British Gaslight Company, Limited, for the past half year, be published, and that the general question of the gas supply of the city be referred to the Parliamentary and Bye-Laws Committee, with special instructions to inquire how far any action on the part of the Corporation or others to obtain another supply may be fettered with the existing monopoly." The only opponent of the motion—Mr. J. Allen—said the resolution seemed to him like an attempt of some one to find out how an opposition company could be started, else why were the words "or others" included in it. The Corporation ought not to pay the legal expenses of any body of men who wished to know what powers they had; while the proposal to negotiate for the purchase of the works was either made to run up the value of the shares of the British Gas Company, or to put more burdens on an already over-taxed city.

The Sanitary Congress Exhibition at Croydon.—The sittings of the Congress of the Sanitary Institute of Great Britain, which opened on the 21st ult. with an address by Dr. Richardson, were brought to a close on Saturday, the 25th. In connection with the Congress, an Exhibition of Sanitary Appliances and Articles of Domestic Use and Economy has been opened on the site of the unfinished Central Croydon Station and the adjacent Skating Rink, and this will remain open daily, from 10 a.m. till 10 p.m., up to and including the 8th inst., on which day the awards of the judges will be made known. The principal exhibits, of course, comprise water supply apparatus, baths and lavatories, water-closets and urinals, and disinfectants; while those relating to lighting, heating, ventilation, cooking, and domestic economy are very numerous, and as well arranged as space will permit. Among the lighting appliances, Messrs. G. Bray and Co., of Leeds, exhibit a complete set of their gas-burners, adapted to every purpose to which a burner can be applied; also a number of globes, brackets, chandeliers, and other apparatus. Mr. J. Sinclair, of Leadenhall Street, has, at Stand 112, several of Stott's self-acting gas-governors, an illustration and description of which appeared in the Journal for Sept. 30, p. 513. Messrs. J. Edmundson and Co. show one of Wigham's patent atmospheric gas machines, and the Portable Gas Apparatus Company one of their machines for the manufacture of illuminating gas from vaporized gasoline; while Messrs. Jones and Willis, in their display of gas-fittings, testify to what extent art metal-work may be employed in that particular section of the gas industry. In gas cooking and heating stoves, Messrs. Billing, of Hatton Garden, display some excellent specimens; their *repoussé* sundial heating stove, which presents a glowing appearance in place of the usual wavering reflection, being specially worthy of notice. Messrs. John Wright and Co., of Birmingham, likewise show a good assortment of very useful gas-stoves. The appliances in connection with water supply and house sanitation are too numerous for individual notice; but it may be said that those contributed by Messrs. Doulton and Watts, Stiff and Sons, Jennings, and Hayward Tyler and Co., are all of their usual excellent quality and finish; while, among the disinfectants, the article "Sanitas" and a material called "Oxychlorogene," which is said to be the most powerful disinfectant known, occupy important places. A word of praise should also be bestowed on two excellent collections of high-pressure taps and valves, for steam, water, and gas purposes, exhibited respectively by Messrs. Blakeborough and Sons, of Brighouse, Yorkshire, and Gowan and Co., of Upper Holloway, London.

* "Coal Mines Inspection: Its History and Results." By R. Nelson Boyd, F.R.G.S., F.G.S. London: W. H. Allen and Co., 1879.

THE CORPORATION OF LONDON AND THE METROPOLITAN WATER COMPANIES.

THE Corporation of the City seem anxious to do something with regard to the Water Question, but they do not exactly know what. Hence they are going to ask the Home Secretary if they can be of any assistance to him in his efforts to satisfy the demands formulated by Mr. Fawcett. An idea has gone abroad that Mr. Cross will bring forward some triumphant measure next session, for the purpose of settling all that relates to the water supply of London. Accordingly, everybody who has at any time agitated this question is naturally anxious to share in the honour and glory of the final victory. The Metropolitan Board, as it happens, are shut out; but there is another institution which, although it possesses neither antiquity, Act of Parliament, nor charter, enjoys the liberty of doing as it likes with the little which it can call its own. What hope would there be for London, were it not for Mr. James Beal and the Metropolitan Municipal Association? The idea of the Home Secretary settling the water question without the aid of this invincible society is absurd. The society's funds may not be very large. It has no landed property, neither can it come upon the rates; but it can ask the Corporation to find the money and promote a Bill, so as to afford "general parliamentary "assistance" to the Metropolitan Municipal Association. To this generous enterprise the Corporation are "invited," the said invitation taking the form of a memorial bearing somewhere about ninety-four signatures. At the top of the list is the name of Cardinal Manning, an amiable ecclesiastic who appears to fancy that Mr. James Beal is a great man. Last Thursday the petition—as it is termed—was read at the Court of Common Council, and Mr. Beal was present with some of his friends to support its prayer.

Looking at these proceedings, we must confess that they seem rather curious and out of shape. Why should it be necessary for Cardinal Manning and Mr. James Beal to lay their heads together in order that the Corporation may be moved to meddle with the Water Question? Why should Gog and Magog, Cardinal Manning, and the Metropolitan Municipal Association go and worry Mr. Cross, when he is doing his best to comprehend the merits of the Water Question and to satisfy everybody? It is the fate of the victor to be "encumbered with help." These people think Mr. Cross is going to "do the work," and they wish to have a hand in the doing of it. The Court of Common Council tried to find a fair excuse for busying themselves in this matter; but it was rather hard to see how the affair was to be undertaken. At least one member of the Court complained that he was going to vote "in a fog," and a suspicion was expressed that the Corporation were being called upon to spend their own money in the promotion of somebody else's Bill. Good sense so far prevailed, that after an hour's discussion, or more, it was decided to seek advice from the Home Secretary before giving "general parliamentary assistance" to Mr. Beal and his friends. The petition emanating from these gentlemen was referred to the Gas and Water Committee of the Corporation, with an instruction to "confer with Her Majesty's Govern-"ment" as to the "propriety and possibility" of taking steps by which the undertakings of the various Water Companies might be acquired "for the benefit of the Metropolis." As soon as the Committee have learned Mr. Cross's mind on this subject, they are to report to the Corporation, and then, if thought proper, the notices will be issued announcing the intention of the City Authorities to promote a Bill on the Water Question. What the Bill is to propose does not yet appear, except that, according to the outline sketched by Mr. Beal, it is to suggest every possible way of dealing with the subject; so that, let Mr. Cross's plan be what it may, he will find himself anticipated, somewhat as a general specification will serve to take the wind out of the sails of an unwary patentee.

Whether Mr. Cross will condescend to take the Corporation into his confidence is perhaps a matter of opinion. One gentleman at the Guildhall seemed to think that possibly the Home Secretary would let out a Cabinet secret by giving a gentle hint as to the probable period of the dissolution. We opine that the Corporation will learn very little as to what either Her Majesty's Government or Mr. Cross intends to do. As for the help that may be rendered, the present moment is both too late and too early. The Metropolitan Board might have furnished help to make the existing law affecting the water supply more successful, and in this respect the Corporation have really done well. But this is a chapter of the past. For the future, the help will have to be given when some new enactment appears, supposing there is one to come. But what is to be the outgrowth of all this discussion and interviewing? What new system of water supply is the City or the Metropolis to look for? The utmost that the Metropolitan Board ever proposed on their own behalf was to bring in a special supply for drinking and culinary purposes, showing that the Board's advisers had no expectation of being able to supersede the whole of the present supply by another. But London will never accept the dual system, with its inevitable defects, annoyances, and expense. To carry out any of the magnificent Lake schemes would necessitate an enormous outlay, and there would be a frightful risk that the supply might be cut off by accident or violence. A larger supply of water might be taken from the chalk, but it has been already shown in our columns that the supply of water to be obtained from the chalk strata in the neighbourhood of London is not to be depended upon as by any means likely to meet all the wants of the Metropolis. So far as an improvement of quality is concerned, that will be largely promoted by an extension of the constant supply, and this is an operation which the Local Authorities have it in their power to facilitate under the existing *régime*. In the matter of price, concerning which the complaints are so loud in some quarters, we fail to see that the public are likely to be benefited by putting the Local Authorities in the place of the Water Companies. There is a vague idea that if the Local Authorities could do as they pleased, all would be well. But even these parties must be governed by economic principles. In the first place they must buy the water-works, and in the second place they must charge for the supply, such charge being sufficient to prevent loss. Those gentlemen who occupy warehouses and offices, and think they ought to pay for no more water than they use, will find considerable difficulty in persuading a Local Authority or a Commission to adopt their view, should the control of the water supply be transferred to such a body.

A speech by Mr. Dresser Rogers at the Court of Common Council, during the debate on Thursday last, was warmly cheered by the assembly. The key-note of the address was local self-government as opposed to centralization. The sentiment was good enough, but the logic seems to have been defective. The Corporation were urged to take action on the Beal memorial, in order that the water supply might not pass into the hands of a Government department. At the same time, Mr. Dresser Rogers was "willing to admit that probably "Parliament would not give the water supply to the Cor-"poration." Did the speaker think that the water supply would be confided to the Metropolitan Board? Mr. Cross has distinctly stated that for "very many reasons" the Metropolitan Board of Works is an "unfit body" to have charge of the water supply. The Home Secretary further remarked that the House of Commons has also "decided that "the Metropolitan Board of Works shall not undertake the "water supply of London." How, then, does Mr. Dresser Rogers think to promote the principle of local self-government by ousting the Water Companies? If the Companies are set aside, to whom will Mr. Cross confide the water supply? Not to the Corporation, for even Mr. Dresser Rogers does not expect that; and certainly not to the Metropolitan Board, for Mr. Cross has positively declared that he will not, and cannot hand over the water supply to that authority. A Commission is talked about, and a suggestion made on this point by Mr. Shaw-Lefevre is quoted. But supposing such a Commission to be created, will Mr. Cross suffer it to run alone? Mr. Cross has had experience of the Metropolitan Board, and is evidently dissatisfied with it. If Parliament adopts measures propounded by the Home Secretary, and these measures include a Commission, we may expect to see a very careful leavening of that body with Governmental influence. Mr. Cross will take care, as far as possible, that his scheme is not rendered abortive by an unwilling instrument, such as the Metropolitan Board has proved to be in the matter of the Regulations Act of 1871.

As we have warned the Metropolitan Board against stultifying itself by failing to work loyally under the existing law, so would we now admonish the Civic Authorities to be on their guard, lest by setting aside the Water Companies they make room for the Imperial power to step in, thus creating that very centralization against which Mr. Dresser Rogers has just uttered his patriotic appeal. The Local Authorities have had their day of grace, and it seems strange that they themselves should seek to end it. To them has it been confided to see that the Water Companies perform certain duties, including the extension of the constant service. Still, there is a cry that things are not as they ought to be, and this cry comes loudly from the Local Authorities themselves. If the present system is to be considered a failure, it will be no wonder if the Government takes the matter in hand after its own fashion,

and sets local self-government in a corner. The Act of 1871 might be taken by Mr. Dresser Rogers and his friends as a warning. By that Act a Metropolitan Water Examiner was appointed, who was made to owe allegiance not to the Local Authorities, but first of all to the Board of Trade, and afterwards to the Local Government Board. The appointment has worked advantageously for the public, but we are not aware that the Local Authorities are particularly pleased. At all events, they have never—so far as we can remember—expressed themselves grateful for the existence of Colonel Bolton. Happily for local self-government, Mr. Sclater-Booth is not disposed to join in a crusade against the London Water Companies, and takes a more favourable view of their conduct than Mr. Cross, perhaps for the reason that he knows a little more about them, though Mr. Cross by no means shares the rabid antipathy which many parties display in reference to the conduct of the Companies. But whatever may be the present feelings of Mr. Sclater-Booth, we see the "thin end" of the wedge introduced, and it would not be very difficult to enlarge the powers of the Local Government Board at the expense of the Local Authorities.

A Commission may be created to which the whole of the undertakings of the London Water Companies will be transferred. Or, as we have heard it hinted in one quarter, the Commission may simply act like the Railway Commissioners, to intervene as a species of tribunal between the Water Companies and the public, including the Local Authorities. A Commission of this latter kind would have the disadvantage of adding another piece of mechanism to the other fragments which abound in the Metropolis. Its existence would also be a living censure on the Local Authorities, declaring them "unfit" to regulate the water supply. A Commission to supersede both the Companies and the Corporation, together with the Metropolitan Board, would be more serious still. Altogether, we think the movement at the Guildhall the other day is scarcely likely to promote the interests it is intended to serve. There is also some little ingratitude in the declaration which has been made, that the City suffers more than any other part of London by the present mode of charging for the water supply. On a former occasion we cited a statement which has not been disproved, and which evidently requires repetition—namely, that on an average the New River Company charge on one-third only of the annual value of the City of London. If the City make better terms with a new master, we shall be surprised.

A City merchant may choose to think that he ought to pay for no more water than he needs to wash his hands. But water is not a mere commodity, to be bought, like calico, at so much per yard. It is a great sanitary agent, and each member of the community is the better for the water which his neighbour consumes. According to this wash-hand-basin theory, a man ought not to contribute more than a bare fraction of a penny to the lighting-rate of his district, because the nearest street-lamp sheds only a faint lustre upon his doorstep. So also the City merchant might plead that he ought not to contribute to the main drainage-rate or the sewer-rate in proportion to the rental of his business premises, seeing that these premises contribute only an imperceptible quantity to the sewers. The drainage of a house is just about equal to its water supply. Therefore, if the water-rate is unjust, so is the main drainage-rate and the sewer-rate. But sewer-rates are levied by the Local Authorities, whereas the water-rates are levied by statutory Companies; and this, it may be said, makes all the difference. Accordingly, it would appear that dirty water possesses a virtue and a value which clean does not.

Sale of Shares in the Carshalton Gas Company.—At the Greyhound, Croydon, last Thursday, Messrs. Fuller and Moon sold by auction 84 ordinary £10 shares in the Carshalton Gas Company. Under their Act of 1877, the standard price of gas is 5s. per 1000 feet, and as they are now supplying at 3d. less than that, they could, the Auctioneer stated, pay 10½ per cent. if they pleased; but they are, instead, filling up the reserve-fund, and only dividing 10 per cent. Three lots of five shares each sold for £19 17s. 6d. per share; and the remaining lots at £20 per share. Fifteen of the same class of shares, £1 10s. paid, fetched £6 10s. each, being £5 per share premium.

The Purchase of the Colchester Water-Works by the Corporation.—At a special meeting of the Colchester Town Council on Monday, the 20th ult.—the Mayor (Mr. T. Moy) in the chair—the Town Clerk reported that he had given notice to the Clerk to the Colchester Water-Works Company of the appointment of Mr. E. Easton as the Arbitrator on the part of the Corporation, to ascertain the amount of the net annual earnings of the Company, and the value of the stock, &c., with a view to determining the amount to be paid by the Corporation for the purchase of the undertaking; and he had received a reply that Mr. G. W. Stevenson had been appointed Arbitrator on the part of the Company. He therefore supposed they would proceed to business as early as possible, it being necessary that the contract should be completed within two months from the date of notice of appointment of Arbitrators. In the meantime, the works would be under the supervision of Alderman Papillon, on behalf of the Council.

Communicated Articles.

ON THE EFFECTS OF THE CONTACT OF TAR WITH COAL GAS.

By Mr. R. H. Patterson, F.S.S., late Metropolitan Gas Referee.

Conclusion.

Mr. Bowditch, as has been shown, laid it down in his book that whatever arrangements might be adopted for remedying the defects of the ordinary process of condensing coal gas, it must be done in a "hot condenser;" and that the best form of such an apparatus would be one substantially similar to "Warner's Condenser," in which the crude gas is made to pass upwards through a heated coil, whereby the heavier portion of the tarry vapours would be deposited in the lower part of the apparatus, leaving the light hydrocarbons either to remain in the gas, or else, if deposited, to be separated from the gas in the upper part of the apparatus, and trickle downwards against the ascending gas stream, so as to give an opportunity for the gas (which by this time is freed from the heavier tarry vapours) to re-absorb them.

In Mr. Aitken's first patent (1874), besides the application of the analyzer to this new purpose, several other methods were described—one of which was "a very large chamber, kept warm"—the object of the chamber being made "very large" being "to allow the tars that are mechanically suspended in the gas to *settle out*." In the Referees "Ammonia Report" (1871)—which, like all the others, was prepared by myself—I suggested the employment of a large chamber for the same purpose, with reference to the fine tarry particles suspended in the gas, and which were found to resist condensation by any of the ordinary methods;* and such chambers have since then been adopted at the South Metropolitan Gas-Works. In the very large and heated chamber of Mr. Aitken's first patent, the gas would gradually be freed from the heavy tar by the effects of gravitation, and at a temperature ("not less than 90° Fahr.") which would allow of the light hydrocarbons to a considerable extent remaining in the gas. But this apparatus did not accomplish the "fractionating" of the gas, such as had been further recommended by Mr. Bowditch.

The analyzer, however, meets all the requirements of the case, at least so far as existing knowledge goes. This apparatus, as its patentees observe, "is very similar to the ordinary Coffey still analyzer." It consists of a vertical chamber fitted with horizontal trays, the gas passage being alternately at the sides and in the centre of the trays, so as to make the gas "travel in a tortuous course;" and in each alternate tray, where the gas passage is in the centre, a wire-gauze tube hangs down from the orifice, dipping into the tar on the tray beneath, in order to promote by friction the separation of the mechanically suspended tars from the gas as it passes upward through the wire gauze. The bottom of the analyzer is occupied to some depth by the deposited tar; and the whole is kept warm—indeed, at the bottom, hot—by steam; two or more lower trays, and also the bottom of the apparatus, being cased, or made double, for the reception of the steam. The crude gas from the hydraulic main is admitted at the bottom, over the surface of the heated tars, so that it is bathed in the comparatively volatile hydrocarbon vapours floating over the hot tar. The gas then ascends through and over the surface of the trays, depositing first its heavier and then its lighter tars; and these flow down over the trays and the wire-gauze tubes against the ascending gas stream. By this arrangement a considerable portion of the light naphtha vapours (which in the ordinary method of condensation are deposited) is probably—I think certainly—retained in the gas, without being deposited at all; while the portion of the naphtha vapours which is deposited, being condensed last and on the topmost trays, will, as it flows downward, be presented *by itself* to the gas, and at a point where the gas (having been freed from the heavy tars) is in a condition to absorb some portion of this volatile substance.

The analyzer of Messrs. Aitken and Young could be introduced with little or no disturbance of the ordinary course of gas manufacture; it could readily be adopted in any large gas-works; and it seems surprising that it has not yet been adopted in England. It is employed in one of the smaller Scotch gas-works, and has been reported upon by Dr. Wallace; but the report upon its operation which has mainly gained publicity, comes from Gibraltar, in a letter which appeared a few weeks ago in the Journal.† That report has been made in a thoroughly satisfactory manner, and it is *nearly* all that can be desired as regards the testings applied; and the effects of the analyzer, as therein stated, prove to be exceedingly valuable.

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* On the same subject, in my treatise on "Gas Purification," published in 1873, I remark: "Even although the *cooling* of the gas could be adequately effected in the ordinary condensers, these vessels, or rather pipes, *offer no facility for the mechanical settling*, or deposit of the tar. The smaller the pipes, the larger the surface of gas exposed to the refrigerating influences, but the greater must be the rapidity of the gas stream passing through them; whereas a reduction of the velocity is requisite to facilitate a settling or deposit of the tar. The tarry element in crude gas, in fact, may be likened to the mud in a river. The narrower the bed and the more rapid the stream, the less opportunity is there for the mud to settle; it is carried forward mechanically suspended in the water. But the mud is readily deposited, and settles to the bottom, on entering a wide and deep pool where the velocity of the current ceases. *Just so is it with the tarry matter in gas.* Hence I consider that whatever be the apparatus for *cooling* the gas, *large chambers* ought to be introduced, wherein the velocity of the gas stream is greatly diminished, so that the tar may settle down, instead of being carried on, mechanically suspended, in the rapid current."—p. 45.

† Letter from Mr. Henry Aitken, enclosing one from Mr. A. Bell, Gas-Works, Gibraltar, in the Journal for Sept. 9, *ante*, p. 398.

I need not quote that letter in full, but it is highly important that its statements, and what they prove, or tend to prove, should be placed as clearly as possible before the gas profession. As in the case of Smith and Farmer's zig-zag condenser, there are two important effects, correlative but not inseparable, to be noted as regards the operation of the analyzer. There is (1) the prevention of naphthaline deposits; and (2) an increase in the illuminating power of the gas.

1. Mr. Bell states that he had been relaying a section of street-mains; and he relaid about an equal length of mains in 1878 and in 1879, and at the same season of the year—viz., in summer. During this work in 1878, he "found the internal surface of *some* of the pipes perfectly covered with large scales of naphthaline; while this year, with the same lines of pipes and season, I have failed to get a single scale, even with a reward offered for them." I have italicized the word "some" in this quotation, because it is possible, of course, that these particular pipes which were found encrusted with naphthaline may have lain nearer to the surface, or in wetter ground, or been otherwise more exposed to cold, so as to promote the formation of naphthaline incrustations. Probably, however, this was not the case, although it would require minute attention in order to ascertain the fact with certainty; and, on the whole, the facts stated by Mr. Bell are as reliable as can be required of any single test or experiment. Accordingly, it may be confidently held that the analyzer is a powerful agent for preventing deposits of naphthaline.

2. The increase of illuminating power from the employment of the analyzer is clearly demonstrated by Mr. Bell's recorded experience. He says: "Formerly I had to use from 6 to 10 per cent. of cannel to enable me to supply 16-candle gas; but after the analyzer got fairly to work, I had to go on reducing the proportion of cannel until the month of May last, when I stopped it altogether." Using "Sugg's Argand"—I presume the London test-burner—the candle-power of the gas, determined by the photometer, was as follows:—

April	16·88 candles;	5 per cent. cannel.
May	18·30 „	no cannel.
June	20·00 „	„
July	18·20 „	„

This shows an increase of just upon two candles in the illuminating power, on the average of the last three months; but it will be observed that the average is greatly raised by the figures for June, and that during the other two months the increase was not quite 1½ candles. Still, this is a most valuable change, for the gain of 1½ candles has been obtained while dispensing with 5 per cent. of cannel. In other words, had the same kind of coal been in use during May, June, and July, the increase would have been considerably larger than the figures, as given, show.

There is a third point and improvement mentioned by Mr. Bell from the employment of the analyzer—namely, an increase in the volume of the gas, or quantity produced and sold, as well as in the illuminating power. But he does not state what this increase was, nor can he speak positively as to how much of it was owing to the analyzer; for, as he states, he began to use an exhauster at the same time as the analyzer, and he has not been able to work these two apparatuses separately, so as to allow him to observe how much was due to the one or to the other. He firmly believes that at least two-thirds of the increase in the make of gas "is due to the analyzer;" but as he does not state what the increase was—probably he is not sure about it—it is impossible for me to say anything on this matter, except that Mr. Bell believes that there has been an increase of his gas-make in consequence of the analyzer.

It is hardly necessary to observe that if there has been an increase in the volume of gas produced, owing to the analyzer, this result is likewise attributable to the increased illuminating power imparted to the gas by the apparatus. It is just an increase of illuminating power in another form. A gas manager, for example, who increases his proportion of cannel may get the result either in gas of higher illuminating power or in a larger gas make of the former illuminating power. And if Mr. Bell not only gets gas of, say, 1½ candles more power, but also gets a larger make of such gas, the effect is the same as if, with his former make, his gas had been improved not merely 1½ candles but considerably more. His statements on this point are, at present, too vague to allow of any conclusion being arrived at; probably he will furnish accurate data before long. But, even as the case stands, it seems beyond question that the employment of the analyzer at Gibraltar gives a gain of about 10 per cent. in the illuminating power or commercial value of the gas.

It may be admitted that it would be unsafe to hold that the effects of the analyzer, stated by Mr. Bell for Gibraltar, will be found invariable, or equally valuable in all other cases where this apparatus may be adopted, although I confess I do not see any reason why this should be so; but undoubtedly the analyzer promises to be so valuable an invention, that its adoption in English gas-works may reasonably be looked for on the grounds of self-interest. In London especially one may look for its early adoption. Firstly, because the London Companies are so wealthy, and their revenues so large, that the cost of experimental apparatus goes for nothing in their expenditure. Secondly, because their gas make is so large that an increase of 10 or even 5 per cent. in their production would cover the cost of new apparatus to a much greater extent than with small companies; indeed, there may be small gas-works where such an increase of production would hardly defray the cost of new apparatus to such extent as to justify the outlay. Thirdly, it is in London that the competition of the electric light (whatever that may be) will be most felt.

I will conclude by venturing a few remarks which may possibly be of some use to companies who are not inclined to adopt the analyzer at present, or may wish to proceed tentatively; especially as these remarks may help to bring out some of the leading facts and principles connected with the subject which has been discussed in these articles—namely, the effects of the contact of coal gas with coal tar.

At present, and hitherto, excepting the erroneous idea recently in vogue as to *prolonging* the contact between the gas and tar, by keeping them together even in the condensers—*i.e.*, when both the gas and tar have become cool—the sole object of all the apparatus between the retorts and scrubbers has been simply to *cool* the gas. So viewed, of course, the high initial temperature of the gas in the hydraulic main was a matter of regret, inasmuch as more apparatus was needed to reduce the gas to the temperature of the atmosphere than if its initial temperature had been lower. But, on the chemical principles first set forth by Mr. Bowditch, acted upon by Mr. Aitken, and recently ascertained and ably illustrated by Mr. Young, it is important that the hydraulic main should be kept *hot*.

Now, of late years, the current opinion has been in favour of lessening the temperature in the hydraulic main, and for admittedly a useful purpose,—viz., to prevent the stoppage of the dip-pipes from becoming encrusted with pitch. And if this stoppage of the dip-pipes were an unavoidable consequence of a high temperature within the hydraulic main, this consideration would go far to militate against keeping the hydraulic main hot. But I do not consider that a high temperature within the hydraulic main need have such consequences. I believe that even with a higher temperature than usual there need be no stoppage of the dip-pipes—a stoppage which can only occur from the tar being subjected to such a heat as will convert it into pitch. And, certainly, the temperature within the hydraulic main is of itself quite insufficient to convert the tar into pitch. Such a conversion, when it occurs, must be owing to the tar being kept in the main for a needlessly long time, and very nearly in a state of stagnation. In some articles which I published in *Engineering*, in 1876, I called attention to the damaging effect of the "tar washing" which gas undergoes in the hydraulic main—an opinion which the Editors of King's "Treatise on the Manufacture of Coal Gas" have done me the honour to quote; and I then strongly recommended that the tar should not be allowed to remain in the hydraulic main, that pains should be taken to draw it off at once, and the liquid should be kept in the main as much as possible in the form of water; so that the hydraulic main, as its name implies, should be a water-seal, and not a tar-seal. Also, a few years ago (in 1875) Mr. George Livesey found that the formation of pitch, and consequent stoppage of the dip-pipes, could be entirely prevented merely by altering the form, or lessening the depth of the hydraulic main; so that no more tar should be kept in the main than was requisite to maintain the seal, and also allow room for the egress of the gas. Accordingly, I see no reason why the temperature of the hydraulic main may not only be maintained at its ordinary point, but also increased, without interfering with the mechanical requirements of the case. By means of the "Livesey hydraulic," or such like form of the main, keeping the tarry liquor in circulation or movement, and drawing it off as speedily as possible, while replenishing the water to maintain the seal, I believe a much higher temperature than that which has hitherto been usual may be kept up within the hydraulic main, without any mechanical difficulty in the form of stoppages of the dip-pipes.

The object to be kept in view as regards the hydraulic main is to diminish (if possible to destroy) the chemical affinity which the heavy tar exercises over the light hydrocarbons, whereby these latter substances, although some of them volatile at ordinary temperatures, are condensed and deposited along with the heavy tars. At present they are condensed and literally pulled down—dragged out of the gas—by their heavier comrades, at a temperature far above that at which they are perfectly volatile; in other words, "permanent gas." The only means of rupturing this alliance, and allowing the nimble Naphtha to escape from the clutches of Giant Tar, is Heat. As Mr. Bowditch found and records, gas may be washed in the tar with perfect impunity, without the least loss of illuminating power, if the contact take place at a temperature of 400° Fahr.; and possibly (although experiments are wanting) a lower temperature would suffice. But the temperature of the hydraulic main is far below that of Mr. Bowditch's experiment. The usual statement is that the temperature of the gas in the hydraulic main ranges from 130° to 150° Fahr.—a degree of heat not high enough to release the light naphthas from the grip of the heavy tars.

The affinity or absorbing power of the heavy tars for the naphthas is so very great that it is almost impossible to *entirely* separate them by the process of distillation—that is, by the application of heat. But there is the above-mentioned experiment of Mr. Bowditch as a starting-point—viz., that at a temperature of 400° Fahr. gas suffers nothing from contact with tar. Further experiments could determine the rest; and Mr. Young, who knows more than any one else upon this point, would do a service by ascertaining what, as a practical question, may be taken as *the temperature at which the contact between gas and tar is innocuous* as regards the illuminating power of the gas. When this matter is ascertained, it ought to be the object of gas managers to *keep the hydraulic main at this temperature*, as nearly as other circumstances will permit. Even where the analyzer is employed, the hydraulic main ought to be kept as hot as can be practically, or without inconvenience, maintained; because, as already said, if the light naphtha be once deposited and mixed up with the tar, it is almost impossible to entirely separate and regain it as by distillation.

In the next stage—namely, after the hydraulic main, and assuming that the tar-well, as usual, is placed next to the hydraulic main—I may offer a suggestion which may be useful in small works, or in others where the analyzer is not adopted; and which can be readily

applied in those works which already have large mains suspended along the walls of the retort-house. It is this—that these mains should be *kept hot*, and also, instead of sloping downwards to the condensers, as at present, they should *drain back into the tar-well*. In this way, the principle of the Rev. Mr. Bowditch's teaching would be observed, although in very inadequate fashion compared with the analyzer.

In short, it is to be remarked that what is wanted to prevent the damaging effect of the contact of gas and tar in the first stage of condensation, is neither mere *quickness* nor mere *slowness*. Merely to draw off the tar promptly into the tar-well will not do, for that would simply carry off the deposited naphtha into the tar-well, where it is as good as lost. Also merely to conduct the present process of condensation *slowly* will do no good; and, if this be done in contact with the tar, it may do evil. The only remedy is an intelligent employment of heat, to destroy the affinity and disrupt the alliance between the heavy and light hydrocarbons; and at present there is no process or apparatus to accomplish this result equal to Aitken's analyzer.

SULPHUR IN COAL GAS.

By "DELTA."

(*Continued from p.* 625.)

It has been shown in a previous article that the carbonic acid and hydrogen sulphide contained in crude coal gas are partially fixed, on condensation and washing, by the ammonia, which is also a constituent of the crude gas. The ammonia, being insufficient to completely neutralize the two acids, divides itself between them in a ratio depending on their relative *affinities* for it, and on their relative *amounts*. If enough free ammonia is added to the washing water, the whole of the two acids can be neutralized and removed in solution. Such an addition of free ammonia to the washers or scrubbers is rendered practicable by Mr. Hills's process of "revivifying" the ammonia liquor which has absorbed carbonic acid and hydrogen sulphide, and been converted into ammonium carbonate and sulphide.

Mr. Hills discovered that carbonic acid and hydrogen sulphide can be eliminated from their compounds with ammonia. When a solution of ammonium carbonate and sulphide is heated to a certain temperature, the ammonium carbonate and ammonium sulphide compounds are *dissociated*, free ammonia and free carbonic acid and hydrogen sulphide being produced, which, when the temperature is reduced, re-combine to form the original compounds. When a compound gas is dissociated by heat, one of the constituents can be separated mechanically from the other, so that the original substance is not reproduced on cooling. For instance, when the solid substance ammonium chloride is heated in a tube, it volatilizes and condenses as ammonium chloride in the cool parts of the tube. But the ammonium chloride does not exist as a compound gas during the volatilization; it splits up into free ammonia and free hydrogen chloride, which on cooling re-combine into ammonium chloride. When this substance is heated in a vessel closed by a porous plug, or when the dissociated gases are passed through a porous piece of pipe, the free ammonia, being of less density than the free hydrogen chloride, passes more quickly through the minute pores of the permeable material, leaving an excess of the heavier hydrogen chloride behind. The proportion of the gases present in the enclosing vessel is thus changed, so that, on cooling, some hydrogen chloride is left uncombined with ammonia. Instead of submitting the dissociated gases to diffusion, and thus increasing the proportion of the heavier constituent in the residue, the gases might be separated by solution. If a solvent, having a greater affinity, at the particular temperature employed, for one than the other constituent, were presented to the dissociated gases, as eparation would be effected which would be the more complete the greater the difference of solubility of the two gases in the particular menstruum. Of such a kind are the phenomena in Hills's liquor process.

As the crude coal gas cools, ammonia, carbonic acid and hydrogen sulphide, hitherto in the free state, combine, and are dissolved as ammonium carbonate and sulphide in the water with which the gas is washed. The ammoniacal liquor running from the bottom of the washers or scrubbers is passed into a boiler, where the liquid is heated a little short of the boiling point. As the temperature rises, the affinity between the base and the acids diminishes, until *dissociation* takes place. But a solvent—water—is present, which, a little below its boiling point, has a much stronger affinity for ammonia than it has for carbonic acid or hydrogen sulphide. The dissociated gases are, therefore, separated by the solvent, for the latter holds back the base, while the two acids are driven off and removed from reach of the ammonia before they are cooled below the point at which reunion occurs. As arranged at the South Metropolitan works, the foul liquor enters at the bottom of the boiler, which is maintained as nearly as possible at a temperature of 205° Fahr., and the evolved gases, consisting of carbonic acid, hydrogen sulphide, ammonia, and steam, pass up through a coke scrubber down which the foul liquor trickles on its way to the boiler. The top of the scrubber is thus kept cool, and all the free ammonia is carried back to the boiler, as well, of course, as a certain proportion of the carbonic acid and hydrogen sulphide, the bulk of which gases, however, pass through the scrubber, and are carried away to an oxide of iron purifier, by which the hydrogen sulphide is arrested, the carbonic acid escaping in a pure state into the air. The causticizing process is continuous.

Foul liquor is run into the bottom of the boiler, and caustic liquor runs off from the top. The revivified ammonia still contains about one-tenth of its carbonic acid and about one-fourth of its hydrogen sulphide. The acids could be completely eliminated if the temperature in the scrubber were raised, but in that case ammonia would also escape. It is found that it is more economical to stop short of complete causticizing, and keep all the ammonia in the liquid.

By washing and scrubbing crude coal gas sufficiently with ammonia obtained by this process, it would be possible to remove all carbonic acid and hydrogen sulphide from the gas; but since it is necessary to have calcium sulphide in the purifiers to remove the carbon bisulphide, the ammonia is used in such quantity as to absorb most of the carbonic acid and a large proportion of the hydrogen sulphide. Were it only necessary to remove hydrogen sulphide and no other sulphur compounds from coal gas, Hills's liquor would easily effect complete purification, both from hydrogen sulphide and carbonic acid, and render the use of large purifying-boxes unnecessary. Hills's process is now employed to save lime. The carbonic acid being almost completely removed from the gas before it reaches the purifiers proper, very little lime is needed to stop the remainder, and there is less danger of this impurity getting into the foul lime boxes and driving off carbon bisulphide, which is held there by the calcium sulphide.

Carbon bisulphide is now removed in the London works, under parliamentary pressure, by means of calcium sulphide obtained by passing gas containing hydrogen sulphide over slaked lime. The metallic sulphide acts towards carbon bisulphide in the same manner as metallic oxides act towards carbon dioxide; in the latter case a metallic carbonate is formed, in the former a compound having an analogous constitution, only having sulphur atoms in place of oxygen atoms—

CaO	+	CO_2	=	$CaCO_3$
Calcium Oxide.		Carbon Dioxide.		Calcium Carbonate.
CaS	+	CS_2	=	$CaCS_3$
Calcium Sulphide.		Carbon Disulphide.		Calcium Sulpho-Carbonate.

Other metallic sulphides will react in a similar way with carbon bisulphide; what seems essential for the chemical union is that the carbon bisulphide should be brought into very intimate contact with the metallic sulphide. When the sulphide is dissolved in water, and the gas containing carbon bisulphide bubbles through the solution, the reaction is very slow. The solvent of the metallic sulphide in this case is almost immiscible with the carbon bisulphide. Nevertheless, a certain amount of chemical action takes place, though the union of the two sulphides is not sufficiently rapid for the purpose of gas purification by a solution of ammonium sulphide. A solution of caustic potash acts rather more quickly than the aqueous ammonia salt, but to obtain any decided absorption of the carbon bisulphide it is necessary to use a solution of an alkaline sulphide in a menstruum which also readily dissolves the carbon bisulphide. With alcohol or ether, such solutions can be made, in which the reacting sulphides are immediately brought into immediate contact, and unite tolerably quickly; but, of course, such solvents would be costly when employed on the scale necessary in large works. It has very often been urged that in ammonium sulphide gas engineers have ready to hand an excellent purifying material for "sulphur"—a material which, as a liquid, would be easy to manipulate, and which could readily be revivified and used again without creating a nuisance. Experiments have not, however, confirmed the advantages claimed by theory for "foul liquor" over "foul lime." To obtain the intimate contact needed for chemical union between the sulphides, it is necessary either to pass the gas over the solid sulphide or to bring them both into solution.

In the "washing of the future" some cheap solvent of the two sulphides must be employed, such, perhaps, as certain higher alcohols (fousel oils), or a process must be invented by which the same solvent can be used again and again without waste. The success of Hills's liquor process, in which no appreciable quantity of ammonia is lost, seems to indicate that such an invention need not be far distant. I have assumed that gas manufacturers will employ whatever means science may point out as the best for sulphur purification, the best method being that which is most to the interest of the maker, the consumer, and the general public. As the case stands at present, the companies are obliged to use calcium sulphide to separate carbon bisulphide from their gas; the solid mass has to be shovelled out of the purifiers by manual labour, after being fully charged with sulphur; the reeking stuff has to be got rid of. These unsavoury tasks the companies have to do without creating a public nuisance in the neighbourhood. Inasmuch as their obligations to the public are concerned, science has laid the companies under an irksome condition. It is scientifically possible to largely abstract carbon bisulphide from the gas, but the process is exceedingly difficult. The gas companies demand from science a more practical reaction, or, in default of this, greater lenity from those in authority.

(*To be continued.*)

SALE OF THE ELECTRIC LIGHTING COMPANY'S (WILDE'S PATENT) APPARATUS AND PLANT.—On Tuesday last, Mr. Statham Hobson sold by auction, at his rooms in Chancery Lane, the whole of the electric lighting apparatus belonging to the above-named Company, a considerable portion of which had recently been in operation at the South Kensington Museum, the Royal Polytechnic Institution, the Gaiety Theatre, and at Messrs. Latimer Clark, Muirhead, and Co.'s, Regency Street, Westminster. The Company are in liquidation, and the sale took place by order of the Official Liquidator. The property sold consisted of 44 lots, the first lot submitted being the Company's interest in an agreement between Mr. Henry Wilde, of Manchester, the patentee, and the Electric Lighting Company, under which the Company are entitled to a licence to use certain patents, and to other benefits and privileges. For this lot there was no offer and the sale of the other lots was proceeded with. Very low prices were realized; and it was stated at the close of the sale that the property had not fetched more than one-tenth of its original cost.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

THE LATE MR. JOHNSON AND THE FREEMASONS.

SIR,—In the JOURNAL of the 21st ult., you note that the son of the late Mr. Johnson was elected into the Masonic Boys School, and state that next year efforts are to be made to place a daughter in the Masonic Girls School. This is so; but may I state, through your JOURNAL, that there is a son of another deceased Brother for whom I am soliciting votes—the son of the late William Clarke Watson, formerly of Kingston-on-Thames Gas-Works, and late of the gas-works, Stony Stratford. I therefore ask my Brother Masons in the gas world to send me their Boys Votes for Watson, and their Girls Votes for Johnson—for the next election, April, 1880.

MAGNUS OHREN,
Secretary, "Evening Star Lodge."
P. P. Grand Warden for Surrey.

STATION-METERS.

SIR,—Fewer station-meters would be overdriven were managers, when asking for tenders, to remember, that the capacity of the drum is its *contents in one revolution*, and therefore an *absolute* thing, depending solely upon size. It is not *relative*, because although the "capacity per hour" may be varied in proportion to the speed, there is a speed which all agree is the best—viz., 100 revolutions per hour.

The "capacity per hour" would, therefore, be the contents of the drum multiplied by 100; but, as this multiple is not always adhered to, it has ceased to be true that the nominal "capacity per hour" of a station-meter is an invariable indication of its capacity per revolution.

The "capacity per hour" would be better *not even mentioned* in the specification of a station-meter.

Edinburgh, Nov. 1, 1879. W. AND B. COWAN.

A MANAGER OF SMALL WORKS writes: "Would any of your correspondents favour me with information on the following points:—A gas main-pipe has been laid in a parish road in Scotland for the last ten years, and the Gas Company were lately obliged to lift and relay it, owing to the proprietors of the estate altering the gradient of the road in order to improve the access to his feuing ground. At whose expense should this be done? Again, has a proprietor the power to compel the Gas Company to remove their pipes out of a parish road at his pleasure? A reply to the above will oblige."

Legal Intelligence.

LEICESTER COUNTY COURT.—WEDNESDAY, OCT. 29.

(*Before Mr.* F. BARROW, *Judge.*)

THE RIVERS POLLUTION PREVENTION ACT.

The first case in this district under the above-named Act, which was passed in 1876, was one tried to-day, where the Rural Sanitary Authority of Lutterworth Union applied, under the sanction of the Local Government Board, for an order against John Read, fellmonger and tanner, to abstain from polluting a stream at Shearsby. It appeared that the defendant has two large works, each of which is on a separate tributary of the same stream. In one tributary were washed not only parts of fleeces with excrementitious matter, but also a large number of skins gathered from all quarters of the globe. These skins, it was suggested, were prepared with poison, probably arsenic, and the result was that the tributary, which just before it entered the defendant's works was so clear and pure that it could be used for drinking and domestic purposes, was a thick, bad-smelling stream after the defendant had used the water.

Mr. T. WRIGHT appeared for the plaintiff; and Mr. BAXTER for the defendant.

The JUDGE, at the close of the evidence tendered, said he did not think it desirable or practicable to order the defendant to buy land at an enormous cost for the purpose of carrying out a system of irrigation, which had been suggested as a remedial measure, and decided that a skilled gentleman should examine the place, and advise him as to what works were reasonably practical to prevent the pollution.

BARNSLEY POLICE COURT.—FRIDAY, OCT. 24.

(*Before Messrs.* J. DYSON *and* W. NORTON.)

FRAUDULENT USE OF GAS.

John Charles Milnes, a labourer of Carlton, was charged with fraudulently using gas, the property of the Barnsley Gas Company.

Mr. DIBB, instructed by Mr. John Hutchinson, the Manager of the Company, prosecuted.

From the evidence given it appeared that the defendant became the tenant of a house in Pindar Oaks Terrace, but as he did not furnish the necessary reference, gas was not supplied. Afterwards he removed to Carlton, and when another family went into the house it was found out that defendant had connected the gas and appropriated it to his own use. It was estimated that he had burnt 1400 feet, of the value of 6s.

Defendant said that he did not intend to do anything that was wrong, and should have paid the money when claimed. He pleaded being in impecunious circumstances.

Mr. DIBB said he did not press the case, the Company only wishing to make it an example to the public.

A fine of 20s., 6s. amount of gas burned, and the costs, was imposed.

LEEDS POLICE COURT.—THURSDAY, OCT. 30.

(*Before Mr.* BRUCE, *Stipendiary.*)

STEALING GAS.

John Leather, of Pembroke Street, Kirkstall Road, Leeds, was summoned for stealing gas the property of the Corporation.

The TOWN CLERK (Mr. G. W. Morrison) stated that on Oct. 21 an Inspector called at the defendant's house, and noticed that gas was burning in the fire-grate. Knowing that there was no meter in the house, the circumstance aroused his suspicion, and he asked defendant where the gas came from. Defendant accompanied him down to the cellar, and it was then found that the fire was supplied with gas by means of a flexible tube running from the service-pipe to the ceiling. The defendant in going into the cellar, endeavoured to disconnect the tube. It was found, however, that a pipe had been connected with it, and that the plug had been removed from the service-pipe.

Defendant said he had used the gas to warm the varnish he employed in his business.

The TOWN CLERK said it was a frequent occurrence in Leeds to cheat the Corporation in the manner the defendant had done, and it would become a question for the Gas Committee whether the next offender should not be proceeded against criminally.

The facts were proved, and as there was no defence, a fine of 40s., including costs, or, in default, one month's imprisonment, was imposed.

BRADFORD (WEST RIDING) POLICE COURT.—THURSDAY, OCT. 30.

ALLEGED ILLEGAL USE OF GAS.

Job Myers, a grocer, of Idle, was summoned by the Airedale Gas Company for unlawfully making a communication with their pipes, and improperly using gas.

Mr. TERRY appeared for the Company, and Mr. NEILL for the defendant.

On the 16th ult. one of the Gas Company's inspectors went to defendant's shop, in the cellar of which he found a pipe through which gas was passing without going through the meter. A clothes basket containing 9 feet of india-rubber piping and a gas-stand were found near the pipe. The meter was originally fixed in the cellar, but a few years ago it was, for convenience, removed into the shop, and the pipe had been left in the cellar. This pipe was connected with the main, so that gas could be obtained from it without being registered by the meter. The Inspector and the Gas Manager went to defendant's shop on the 20th ult., and found that gas was escaping from the pipe.

For the defence, Mr. NEILL said he was instructed to give an absolute denial to the charge. When the building was erected in 1870 the piping was continued along the whole of the cellar. Alterations were afterwards made in the cellar and an additional wall was built. The pipe was walled up, and no gas had been obtained through it.

Witnesses having been called on both sides,

The MAGISTRATES said they considered the case proved, and fined defendant £5 and costs.

It is stated that the decision will be appealed against.

Miscellaneous News.

THE AMALGAMATION OF THE SOUTH METROPOLITAN AND SURREY CONSUMERS GAS COMPANIES.

CONFIRMATION OF THE SCHEME BY THE QUEEN IN COUNCIL.

The scheme for the amalgamation of the South Metropolitan Gaslight and Coke Company and the Surrey Consumers Gas Company was confirmed by Order in Council at the Court held at Balmoral last Tuesday.

The recital of the Order sets forth that the South Metropolitan Company were authorized by their Act of 1876 to amalgamate with any Gas Company (except the Crystal Palace District Gas Company) south of the Thames, the conditions and restrictions, in reference to amalgamation, contained in the City of London Gas Act, 1868, to apply as to the preliminaries to be gone through. These are that a scheme having been settled by the Companies, shall be submitted to the Board of Trade, who by advertisement are to invite representations to be made to them of modifications considered necessary by interested parties; and the Board are to make what alterations they then think necessary. On the Companies agreeing to the modifications, if any, suggested, the scheme is to be submitted to Her Majesty in Council; and, after being confirmed by Order, it is as binding as if it had been enacted by Parliament.

The recital then continues: "Whereas the Board of Trade have considered the scheme, and certain representations which were made to them with regard thereto, and have suggested certain modifications of the said scheme, which modifications were assented to by the Companies; and whereas a copy of the said scheme, as so modified, is set forth in the schedule hereto; and whereas it has been made to appear to Her Majesty that it is expedient that the said scheme, as set forth in the schedule hereto, should be confirmed by Order in Council: Now, therefore, Her Majesty, by virtue of the power vested in her by the Acts hereinbefore recited, by and with the advice of her Privy Council, is pleased to confirm the said scheme."

The Schedule referred to in the Order contains the scheme, which with very few exceptions, is identical with the draft scheme submitted to the Board of Trade, and which we printed in the JOURNAL of the 13th of May last, pp. 722 *et seq.*

The following are the only alterations:—

In clause 14, "Provisions of existing Acts continued," there is this addition: Provided that, in the event of the provisions of any Act relating to the Surrey Company being inconsistent with those of any Act relating to the South Metropolitan Company, the provisions of the South Metropolitan Act shall prevail with respect to, and be observed by the United Company.

In clauses 16, 17, and 18—relating to the Directors—the number of them is reduced to "not more than *seven*, nor less than *five*," instead of nine and six respectively. The compensation to those who retire is to be "equal to *four* years purchase" of the fees received last year, instead of seven years purchase, as in the draft scheme; these retiring allowances to be liquidated "by equal annual instalments during the next *four* [not five] years." The fees payable to Directors continuing in office, instead of being a fixed sum of £3000 per annum, are not to exceed £2600 if the number be seven, £2400 if the number be six, and £2000 if the number be five.

Clause 20, after fixing the number of Auditors at two, provides that "the remuneration shall not be more than £75 per annum each."

Clause 30, "Dividend on Different Classes of Shares," has been altered as follows: All three classes of capital, A [existing capital of the South Metropolitan Company], B [existing capital of the Surrey Company], and C [all new capital created by the United Company], shall participate equally in the profits up to 10½ per cent.; but in the event at any time of a larger dividend than 10½ per cent. being payable on all three classes, one-half of such larger dividend, that but for this agreement would be payable to the holders of B capital, shall be paid to the holders of A capital, in addition to their own proportion of such larger dividend as aforesaid.

The only other variation is that the second proviso of clause 36 is omitted. This was: "Provided also that if the price of 3s. 9d., now charged in the district supplied by the Surrey Company, is reduced to 3s. 2d., and the price of 3s., now charged in the district supplied by the South Metropolitan Company, is continued at that or any lower rate, the United Company may, for a period of twelve months after the commencement of the amalgamation, pay dividends on the capital of each Company respectively at the rate prescribed by section 21 of the South Metropolitan Company's Act, 1876, and according to the price charged in the district of each Company respectively; subject, nevertheless, to clause 30 of this scheme."

SALE OF SHARES IN THE SLEAFORD GAS COMPANY.—On Monday, the 27th ult., 25 old £10 shares, and 25 new £4 shares in the Sleaford Gas Company were disposed of by auction by Messrs. Creasy and Wildgoose. Twenty of the old shares were sold at £11 each, the remainder at £10 15s. each. Five of the new shares fetched £4 7s. 6d., the rest £4 6s. each. The whole of the shares are receiving a dividend of 6 per cent., free of income-tax. The total amount realized by the sale was £381 12s. 6d.

SINGAPORE GAS COMPANY, LIMITED.

A Meeting of this Company was held at the City Terminus Hotel, Cannon Street, on Tuesday Oct. 21—H. P. STEPHENSON, Esq., in the chair.

The SECRETARY (Mr. Robert King) having read the notice convening the meeting, the following report and accounts were presented:—

The Directors have to report continued progress in the lighting of Singapore, for particulars of which they refer to the report annexed, from their Engineer and Manager, Mr. E. J. Wells, dated Sept. 1, 1879.

The balance-sheet to June 30, 1879, appended to this report, shows the financial position of the Company. The Directors have written off for depreciation of works and plant, and off the expenses of first establishment, as per balance-sheet, at the rate of 1 per cent. per annum. The profit for the half year, after writing off these sums, amounts to £2378 8s. 9d., which together with £750 11s. 10d., the unappropriated profit of the preceding half year, makes the available balance £3129 0s. 7d. Out of this sum the Directors recommend the declaration of a dividend at the rate of 7½ per cent. per annum, less income-tax, on the amounts paid up on the preference and ordinary capital; the balance of £816 6s. to be carried forward to the profit of the succeeding half year. The dividend to be payable on the 20th of November.

REPORT OF ENGINEER AND MANAGER.

Gas-Works, Singapore, Sept. 1, 1879.

Gentlemen,—The time has arrived for me to lay before you another half year's report, being the thirty-second half-yearly report I have had the honour to submit to you. As usual, I have forwarded all the statements and accounts for the half year, and the Banker's voucher, certifying the balance at the bank on the 30th of June last. I trust all the documents will reach you safely, and will be found correct.

Notwithstanding the general depression of trade in Singapore during the past half year, and the low rates at which petroleum could be purchased, and also the introduction of large numbers of cheap lamps for burning petroleum, I think it may be considered that good progress has been made, and that the increase in the gas-rental has been satisfactory. As compared with the corresponding half year of 1878, the increase in the private gas-rental is 1093·43 dols., and in the public lamps rental 799·50 dols.

During the past half year money has been difficult to collect, but the collection has been, on the whole, satisfactory, 46,003·04 dols. having been paid to the bank. The collectors districts have been rearranged so as to facilitate the collection, and there are now three districts instead of two as formerly.

As I stated in my last report would be the case, rates of exchange have ruled very low during the half year, the average on six months bank bills being 3s. 8½d. per dollar, compared with 3s. 11½d. in the corresponding period of 1878, causing a loss on the amount remitted of £1035 1s. 4d. I am of opinion that the rates for the current half year will cause almost as heavy a loss as in the last.

In the retort-house we have commenced to take down No. 6 bench of retorts, and shall re-set it with seven oval retorts; when No. 7 bench is let down, this will be similarly re-set with seven retorts. These benches were completed in July, 1876, and have done good service. The general efficiency of the works, plant, and mains, has been well maintained during the half year. The Engineer's report will furnish you with all the working details. The gas has been kept free from impurities, and maintained at an illuminating power of 15 candles.

In the fitting department we are very busy, as, in addition to the usual work, we have in hand the fitting up of the New Exchange and Club, which will be lighted up about the 10th inst., and the fitting of the new flagstaff with the harbour light, two of Sugg's new burners, with powerful reflectors, being used. The illuminations for the Chinese Festival commenced yesterday, and will continue for 14 days.

By the s.s. *Glenartney* I hope to receive the lamp-columns with Sugg's new 50 and 100 candle burners, which will be fixed as soon as they arrive. During the half year 30 new houses have been fitted up, 413 additional lights being fitted in them, and in houses previously supplied with gas.

I have nothing more to add than that I hope to hear that the half year's working has been considered satisfactory by the Directors and Shareholders.

(Signed) E. J. WELLS, Manager.

DR.—*Balance-Sheet, June* 30, 1879.

To Capital—			
£5 paid on 2,000 preference shares		£10,000	0 0
£5 „ 10,597 ordinary shares		52,985	0 0
		£62,985	0 0
Debenture bonds		350	0 0
Sundry creditors		1,353	18 2
Insurance reserve-fund		205	14 6
Profit and loss		3,129	0 7
		£68,023	13 3

CR.—*Balance-Sheet.*

By Works and plant, to Dec. 31, 1878	£35,984 10 2		
Amounts charged to capital, for travelling expenses, rent, preliminary expenses, and interest on capital during construction, as per balance-sheet, Dec. 31, 1878	9,773 12 8		
	£45,758 2 10		
Add extensions this half year	15 12 0		
	£45,773 14 10		
Less amount now written off, at the rate of 1 per cent. per annum	228 17 4		
		£45,544 17 6	
Purchase of land		1,118 2 8	
Cash at Bankers, London and Singapore	£978 19 11		
Ditto in hands of Secretary	10 12 8		
Bills receivable	2,100 0 0		
		3,089 12 7	
Office furniture		89 14 6	
Retort account		953 16 7	
Stock on hand		12,166 13 7	
Gas and meter rental, fittings, and sundries under collection—			
Amounts due to June 1	£3,505 5 6		
Ditto for the month of June	1,555 10 4		
		5,060 15 10	
		£68,023 13 3	

DR.—*Profit and Loss Account, from Jan.* 1 *to June* 30, 1879.

To Coal carbonized	£2,412 0 2
Lime and oxide	21 17 6
Trade and general charges	407 0 8
Rent, rates, and taxes	148 3 3
Directors and Auditors	210 10 0
Salaries and Collectors commission	764 19 0
Wages	436 12 1
Interest on loans and debentures	44 6 0
Loss on exchange	1,035 1 4
Bad debts and allowances	85 10 0
Retort account	170 0 0
Meter repairs and renewals	77 13 3
Depreciation on works and plant, and expenses of first establishment written off	228 17 4
Office furniture	5 0 0
Balance—profit for appropriation	3,129 0 7
	£9,196 11 2

CR.—*Profit and Loss Account.*

By Balance at profit and loss, Dec. 31, 1878	£3,063 6 5	
Less amount declared as dividend, after deducting income-tax	2,312 14 7	
		£750 11 10
Gas and meter rental		6,736 7 5
Products, profit on fittings, and sundries		1,709 11 11
		£9,196 11 2

The CHAIRMAN, in moving—"That the report of the Directors, with the balance-sheet attached thereto, be received, adopted, and entered on the minutes," said he thought it was scarcely necessary for him to make any remarks further than to say that they proposed to pay a dividend at the rate of 7½ per cent. per annum, after writing off 1 per cent., and would then carry over something like £60 more than they brought forward.

Mr. ALFRED WILLIAMS seconded the motion.

Mr. H. W. SMITH thought that a very large amount—over £12,000—appeared in the balance-sheet for stock, and he asked whether they could not work with the same efficiency, and probably with some economy, if they reduced this item, which appeared to him to be very large. He could not refrain from expressing some disappointment at the dividend they were receiving. It occurred to him, from the increased charge for the public lights and the reduced price of coals, that there might have been some hope of an additional dividend, and he thought that many other Shareholders besides himself were rather disappointed at the dividend being the same as the last. They had not made the least progress in this respect for the past five or six years, and he thought that the Shareholders would have been pleased with another half per cent.

Captain REINECKER thought that the Directors had adopted in the balance-sheet a very wise course as to the amounts charged to capital for the works account. He supposed that in future it would appear as one total sum, and, if so, he thought they might congratulate themselves on an improvement in the balance-sheet. In view of the great danger to the Company, and others having property in the East, in connection with the Eastern Question, he threw out the suggestion to the Board that, with others having property in the East, they should form a deputation to the Colonial Secretary, with the view of obtaining protection. He thought that such a deputation would be very much to their advantage.

Mr. R. J. LAING said he missed from the accounts this half year the item of "Public lamps," and he asked for an explanation. He also required some information as to the meter renewal account and the item of "Sundry creditors."

The CHAIRMAN, in reply, said as to the amount of stock at Singapore, he agreed with Mr. Smith that it was larger than it ought to be. It was not the first time that the Board had drawn the attention of the Manager to the point. They had £6000 stock in coals and £6000 stock in fittings, and he thought that they were larger than they should be, and he would take care that the Manager had his attention again drawn to the matter. As regarded the other subject referred to by Mr. Smith, he was very sorry that that gentleman was disappointed as to the dividend. He (the Chairman) could say for himself and his co-Directors that they were not, nor did he think the Shareholders generally were. They had now for 13 half years paid a dividend of 7½ per cent. per annum, and although the Shareholders might say it was not a very large dividend, still it was an exceedingly respectable one; and he thought that they generally would be more satisfied to keep a safe and sound 7½ per cent. dividend than go up to a dividend which they might not afterwards be able to maintain, which would have the effect of sending up the shares to a fictitious price, and enable many to sell out at a profit and leave them in the lurch. That was a position in which neither the Company nor the Shareholders ought to be placed, and nothing, he thought, was more pernicious than to pay a dividend which could not be maintained. As soon, however, as the Directors could see their way to give the Shareholders an increased dividend, they would readily do so, as it was to their interest that the dividend should be larger. It was to be remembered that they were then suffering to the extent of very nearly £2000 a year by loss on exchange, and that amount, if put into the form of dividend—if they could save it—would represent an increase of very nearly 4 per cent. in the dividend upon their ordinary share capital. That was the reason he would give Mr. Smith for the present dividend not being more than 7½ per cent. If that gentleman would show them a means by which they could save this loss of £2000, he would give them his pledge that the dividend would go up one-half per cent., and perhaps rather more. Captain Reinecker had raised a question as to proceeding with a deputation to the Colonial Office; but he thought he must look a little more into the matter before he could pledge himself that they would act on the suggestion. Captain Reinecker, no doubt, had some reasons which he had not disclosed, and perhaps when the matter was carefully considered there might be something in it, and then some steps could easily be taken. With regard to Mr. Laing's remarks, the public lamps, under the old contract, were paid for each half year; but they were now paid for monthly, and they had therefore merged them in the ordinary manner into the amount due for the month of June. The £3505 in the balance-sheet represented the outstanding arrears at the date of the accounts, and the £1555 represented the amount owing from private and public lighting for the current month of June. It had always been included in the general rental in the profit and loss account. Last year there was six months public lighting owing, and it was included as six months owing; but now five months out of the six had been paid, and, therefore, there was only one month owing for at the time the present balance-sheet was drawn out. As to the meter renewal account, it had been entirely liquidated out of revenue, till they put something more to it. The "Sundry creditors" showed an increase of £992, which was not very heavy.

The motion was then unanimously agreed to.

The CHAIRMAN moved the declaration of a dividend at the rate of 7½ per cent. per annum, less income-tax, on the preference and ordinary shares.

Mr. R. S. FOREMAN (a Director) seconded the motion, which was carried unanimously.

The CHAIRMAN moved a vote of thanks to Mr. E. J. Wells, for the able manner in which he had discharged his duties, and also to the local Committee at Singapore.

Mr. WILLIAMS seconded the motion, and it was carried.

The CHAIRMAN remarked that he was very glad to find that there was sufficient interest taken in the Company by the Shareholders to induce them to point out what they considered any little faults and deficiencies. He was always glad that these things should be mentioned. He was quite sure that it was beneficial to the Company that these questions should be asked, and that all the Shareholders should have an opportunity of satisfying their minds on any point as to which they had any doubt.

Mr. RICE said it was a great pleasure to attend the meetings of the Company, for the reason which the Chairman had just stated—that when questions were asked, the Shareholders always received very satisfactory answers. He then proposed a vote of thanks to the Chairman and Directors for their very judicious management of the affairs of the Company during the last half year.

Mr. SMITH seconded the motion, which was carried unanimously.

The CHAIRMAN having returned thanks on behalf of himself and his colleagues,

Mr. WILLIAMS moved a vote of thanks to the Secretary, Mr. King. Being one of the Auditors, he could see how ably Mr. King discharged the duties of his office.

Captain REINECKER seconded the motion, which was carried unanimously.

Mr. KING briefly returned his acknowledgments for the compliment, and the meeting terminated.

METROPOLIS WATER SUPPLY.

Court of Common Council.

At the usual Meeting of the Court of Common Council, last Thursday—the Lord Mayor (Sir Charles Whetham) presiding—there was presented a memorial "of ratepayers of the Metropolis, praying the Corporation to render them such general parliamentary assistance that the notices required by the Standing Orders of Parliament may be given for the introduction of a Bill in the ensuing session for the amendment of the Metropolis Water Act, 1852, and the Acts amending and altering the same; to provide a constant and purer supply, and for the due administration and control of the Companies; reduction and uniformity of rates; for the purchase, if so deemed requisite, by agreement or under parliamentary powers, of the undertakings of the Companies by a body to be nominated by Parliament or created for the purpose, with such powers as may be requisite to effectively deal with the subject in the interest of London." The memorialists having attended at the bar,

Mr. Beal stated, in reply to Deputy Fry, that they did not represent any society or public body, but were the deputies of a meeting of ratepayers held at Cardinal Manning's residence, where they had been joined by members of some London Vestries. He was quite aware that the Home Secretary had made a general promise in the House of Commons that something should be done in the matter of the water supply of London, but it was in consequence really of the statement by Mr. Cross that the memorialists were taking their present action. They wished that the Government should not allow the matter to drop. In reply to Deputy Taylor, he said that he knew the Metropolitan Board of Works had taken up the question the session before last, and that they had incurred very considerable expense in appearing before Parliament—£16,000. The reason the memorialists had come to the Corporation for assistance, instead of carrying on their movement outside the City, was, that the ratepayers themselves possessed no municipal authority, and could not give the parliamentary notices.

Deputy Taylor asked whether the petitioners thought, in the face of the discussion on the question which had seemed to give satisfaction to all parties in the House, it was right to meddle in the matter until Mr. Cross had intimated what he was prepared to do.

Mr. Beal said he thought their action would not weigh with the Home Secretary.

Mr. Rudkin said for his own part he had confidence in the pledge which had been given by Mr. Cross. At the present time, however, it was just possible that the Government, even with the existing majority, might require the assistance of the Metropolis at large.

Mr. Bontems then proposed, in accordance with notice—"That it be referred to the Gas and Water Committee to confer with Her Majesty's Government as to the propriety and possibility of taking steps by which the undertakings of the various Water Companies may be acquired for the benefit of the Metropolis, and to report thereon forthwith." He said he considered that the Water Supply of the Metropolis was one of the principal questions of the day, and, in his opinion, it behoved them, as the oldest Corporation in the Metropolis, to display interest in the matter. Hitherto they had not, it must be admitted, shown much interest in it, but the Metropolitan Board of Works had taken some action, and the Home Secretary had made a statement in the House of Commons. If the Government were sincere in their desire to further the water question, they would be glad of assistance not only from the Court, but from every Vestry in the Metropolis, and he did not think they need incur any expense in the matter. The water supply was very different from almost every other question of improvement; the money could be borrowed at a very low rate of interest, and all that would have to be done would be to place the undertakings in the hands of persons who would manage them so as to compensate the present holders of the shares of the Companies, and reduce the price of water to the consumers. He was certainly of opinion that they could do no harm in going to Mr. Cross.

Mr. Isaacs seconded the motion. He said it might be, indeed, that the Government which had bought the Suez Canal shares might determine to buy up the Water Companies shares; and his own impression was that if they were prepared to do this they would do a very popular thing. It would be the duty of the Corporation to assist the Government by every means in their power.

Mr. Rooke said that Mr. Fawcett had recently expressed his opinion that the petitioners ought not to come before the Court with their memorial, there being many reasons why the Government should not be hampered. Mr. Fawcett himself had withdrawn his notice of motion in the House of Commons on the question of the water supply, because he had received a distinct understanding that the Government would deal with the matter.

Deputy Kelday said he would like the Court to consider for a moment what position the Gas and Water Committee would be in if this reference were made to them. He had on the paper of business a report from the Committee "upon the several references relative to the Supply of Water to the Metropolis, and recommending that they be discharged; and, further, that the Committee should be authorized to watch any proceedings that may be taken by the Government with respect to the Water Supply of the Metropolis." The reason he had been authorized to bring up this report from the Committee was that they had relied upon the promise made by the Home Secretary that he would attend to this matter; and seeing that there were a considerable number of references outstanding relative to the same subject, the Committee had thought it desirable to clear them off, and wait to see what the Government intended to propose. If the reference now moved should be made, it would only add another to those the Committee had already been charged with. In July, 1876, the Committee had been authorized to consider the desirability of conferring with the Government on the question; and again, in November, 1877, there had been a reference to confer with the Government and with the Metropolitan Board of Works. These conferences had not been held, and if the Court passed the resolution which had now been proposed, they would only be repeating the references which already had been made. It might be that when he brought up the report, the Court would not assent to it. He simply made these remarks in order to indicate what result the reference would be likely to have.

Mr. M'George protested against their going to the Government with such a crude, undigested case. He thought it preposterous that without any definite scheme they should apply to the Government to take a step which required the expenditure of 23 or 25 millions of money.

Deputy Shephard observed that the matter was under the consideration of the Committee already, and that no good would arise from sending further references to them.

Mr. Bedford thought the Government required assistance, and that they would be very glad to get the assistance of the Corporation.

Mr. Rogers said he did not blame the Companies for trying to get as much as possible for themselves, but he was of opinion that the Metropolis ought not to be behind Manchester in a public matter of this kind. Water was a primary necessity of life, and should on sanitary grounds be supplied cheaply to the public. It was not a trading commodity in any way whatever, and the Authorities were bound to take charge of its supply, and give it to their constituents at the cost only of delivering it. Parliament had never yet lost sight of vested interests, and he believed would in future be guided by the same considerations as in the past. The amount of money the Companies required for the purpose of paying dividends to their Shareholders was worth a corresponding number of years purchase. He was willing to admit that the Government might not ultimately give the charge of the supply to the Corporation, but the Corporation had not been guided by simple motives of this kind in the past, and he apprehended they would not limit their action by them in the future. He considered that *pro raté* the Corporation and the citizens of London would derive a greater benefit than any other part of the Metropolis from the taking over of the Water Companies by the Government. He thought they had a great case, and it was quite possible for the Local Authorities to retain the power in their own hands, and not let it pass into those of Government officials.

Mr. Bengough thought that if the gentlemen who had now come before them had not muddled the gas question in the past—if the gas supply had been allowed to remain in the position it then was—the matter would have been righted much sooner. With regard to the Water Companies, he did not, for his own part, think that all the virtue was on the side of the consumers. It was a great pity the Companies were allowed to charge according to the assessment. It was a mistake to say that the City of London paid more than any one else. They did not pay more according to their assessment, but the houses they lived in were assessed higher. His own advice was to trust to the Government, though, of course, the deputation which had waited upon the Court with the memorial would not approve of anything which did not permit them to have a finger in the pie.

Deputy Fry observed that for the Corporation to bring in a private Bill in reference to the water supply would, he thought, be an insult to the Government, in face of the fact that both sides of the House had been so decided in their wish that something should be done, when the matter had been debated there.

Deputy Taylor considered the question was one of policy. They were all seeking for the same object, but they were seeking it by different means. He thought they would find the Government rather reticent in the matter of what they contemplated doing, but he was quite sure that the Government would do something with reference to the London Water Companies. If it had not been for the discussion in the House of Commons, he thought the Corporation might have taken some action themselves. Mr. Shaw-Lefevre had said in the House that he hoped the Government would be able to adopt some mode of dealing with the question, so as to establish a Commission on which the Metropolitan Board of Works and the Corporation would be represented, and that he (Mr. Taylor) thought would work satisfactorily. From this it would appear that a course was foreshadowed which was to give the Corporation and the Metropolitan Board a working hand without placing the absolute control in the hands of either. They might rely upon it, the Water Companies would get all they could, and, indeed, they were entitled to full consideration for their property. He believed they would all agree as to the desirability of a great change in respect to the supply to London of one of the necessities of life.

Mr. Shaw thought the Gas and Water Committee might be authorized to go to the Government to ask whether it was their attention to deal with the matter during the ensuing session.

Mr. Rudkin remarked that such a course would be practically an insult to the Government, because they had already expressed their intention of moving in the matter. He would agree to Mr. Bontems's motion, because it instructed the Gas and Water Committee to do what they had not yet done, although they had been empowered to do it for something like eighteen months or two years. What they wanted was that the Committee should do this at once—that the Government should be asked whether the Corporation could be of any assistance to them, or whether the Government thought it would be better for some Local Authority in London to give the necessary notices.

The motion was then agreed to.

The following notice of motion, which stood in the name of Mr. G. C. Boor, was consequently withdrawn:—"That it be referred to the Gas and Water Committee to consider and report to this Court as to whether the time has not arrived when the Corporation, alone or in conjunction with the Metropolitan Board of Works, should apply to Parliament for the repeal or amendment of certain clauses in the several Water Companies Acts, more especially the clauses that give them power to base their first charge for water on the assessment or value of property, and to inquire generally into the Acts that govern the supply of water to the Metropolis."

THE ACCIDENT FROM AN ESCAPE OF GAS AT WORKSOP.

Fatal Result.

Last Thursday an inquest was held at Worksop on the body of Rebecca Keeling, a maiden lady, aged 53, who was, on the Wednesday in the previous week, found lying on the floor of the house in which she resided, under circumstances noted in last Journal. The jury having viewed the body, the following evidence was given:—

Dr. *Arthur Russell*, Surgeon, of Worksop, said that he was called to see deceased on Wednesday, Oct. 22, at half-past seven o'clock in the evening, at the Cattle Market Hotel, where a bed had been made for her on a table. She was perfectly unconscious, and was snoring hard. She had a blue expression of countenance. She was not burnt or injured, but there was about her a very strong smell of ordinary coal gas. He continued to attend her until her death, which happened on Sunday night, Oct. 26, at nine in the evening. There was but little change during all that time. Once or twice she appeared to become slightly more conscious, but almost at once relapsed into coma. She was never able to speak, but moaned a great deal. She took a quantity of stimulant—brandy, &c.—during part of the time. She was lame. He thought that deceased had been taken in an apoplectic fit, for had she been simply under the influence of gas she would have come round, considering the time she lay. She had had a fit about six months before. Judging from the length of time which she lived, she would probably have recovered from the effects of the gas had there not been an additional seizure, and the two combined, acting upon her already enfeebled frame, would be quite sufficient to account for death. His idea of the cause of her death was coma, produced from the apoplectic seizure and the gas combined.

Mr. *William Bates*, Manager of the Worksop Gas Company, said that he was sent for about an escape of gas at the Cattle Market Hotel on Tuesday, Oct. 21, about half-past ten o'clock at night. As it was then closing time, he sent word back to turn off the gas and use candles, and he would come up next morning and look into it. Next morning he went there, but could not find anything. He visited the place several times during the day; and at six o'clock went again, and directly afterwards perceived a bad smell of gas in the pantry, and other parts of the house. He examined the premises, and then went to Miss Keeling's next door, and smelt at the key-hole, but could not distinguish much smell. He made inquiries of the landlord as to whether he had seen Miss Keeling, and on getting a negative reply, he (witness) said he should break open the door. He obtained a ladder, and went to the front window, raised it,

and found that there was an escape of gas in her house. He went to the back door, and broke it open with a crowbar, when the smell was very strong indeed. He at once made his way upstairs, first telling those about the house to keep lights away; felt in the dark for the bed, and found it was empty; walked round the bed and felt all about for deceased; and, not finding her, went downstairs again and pushed against the door leading to the front room. There was some obstacle, and on pushing harder, the door gave way and he fell forward over a body laid face downwards on the floor. It was Miss Keeling, and she groaned. He felt with his hand to discern her position; and then went and obtained something with which he knocked up the service-pipe where it entered the house. He sent some one for the doctor, and then had deceased carried next door to the Cattle Market Hotel. He locked up the house, as it was not fit for examination. Next morning he went with Mr. Hobson, a trustee of the property, and together they examined the house. A chair was against the table, and on each side were the boots of deceased, as if they had just been taken off. A dry mop was lying close to her, and the crutch with which she usually moved about was in the kitchen. It appeared, from the position in which it lay, that she had used the mop as a crutch. The gas pendant was ipulled down from the centre of the room, and lay on the table close to the chair, the top towards where she was lying. There would be an escape of gas of about 120 feet per hour for 24 hours.

Mrs. *Eliza Steadman*, landlady of the Cattle Market Hotel, said that she knew Miss Keeling very well. First noticed the escape of gas in the pantry on Tuesday night. Last saw the deceased on Tuesday morning, when she did not seem well, but did not complain. She seemed very weak. Did not see Miss Keeling again till she was brought to her house on Wednesday evening. The smell of the escape of gas returned very strongly on Wednesday evening. Miss Keeling lived alone. She had not been in very good health for some time.

Evidence was then given that deceased was seen alive as late as half-past seven o'clock in the evening of Tuesday; one of the witnesses, who said he knew the deceased well, stating that he had seen her take hold of the gas pendant as a means of supporting herself as she walked round the table. She did this to steady herself.

The CORONER (Mr. Denman) commented upon the evidence given, and

The JURY returned the following verdict:—"That deceased died whilst in a state of coma, produced by an apoplectic fit and the effects of gas poisoning combined."

The CORONER complimented Mr. Bates upon the way in which he had acted over the unfortunate affair.

RETFORD CORPORATION GAS SUPPLY.

A Special Meeting of the Retford Town Council was held on Friday, the 24th ult., for the purpose of receiving the annual report of the Gas Committee. This commenced by congratulating the Corporation upon the success which has so far attended the undertaking. The exact cost of the works was £27,744 11s. 7d., and at the time of the purchase there was considerable opposition in the town. It now transpires that, after paying all interest on capital, &c., there has been a net gain on the past year of £804 15s. 1d. When the Committee took the management, they found it absolutely necessary that certain improvements and alterations should be made in the works. These have now been completed, and in addition to increasing their power of supplying gas, it will, they say, considerably reduce the cost of manufacturing it, and the Committee recommend that after the 31st of December next the price of gas shall be reduced by 5d. per 1000 feet. The coals carbonized during the first half year were 1652 tons, and during the second half year 1542 tons. The average price obtained for the gas sold, after allowing for the discounts, and including the money received under the contracts with the Railway Companies and for lighting the public lamps, was about 3s. 9d. per 1000 cubic feet. The revenue account shows a profit of £434 1s. 9d. for the first, and £527 6s. 8d. for the last half year.

The MAYOR proposed that the report be adopted, and that the thanks of the Corporation be given to the Gas Committee for their services.

Mr. JOHNSON having seconded the motion,

Mr. MARSHALL said that he failed to see that there was any sufficient reason for congratulating themselves and the town upon the undertaking, and he would, therefore, move that the first paragraph of the report be struck out. With regard to the proposed reduction of 5d. per 1000 feet, he thought the Committee were scarcely in a position to know what reduction to recommend, and he was told by a Director of the old Company that the reduction ought not to be less than 9d. per 1000 feet. Then the average price of gas was stated to be 3s. 9d. per 1000 feet, and he thought the ratepayers should be supplied at as cheap a rate as the Railway Companies.

Mr. HUNTSMAN, the Chairman of the Gas Committee, said he understood Mr. Marshall to move some sort of censure on the Committee for the way in which they had congratulated the Corporation upon obtaining possession of the gas-works. Having watched the working of the undertaking for the past nine months, he was perfectly satisfied that the town possessed in them a most valuable property. As the town extended, they would, of course, require additional capital to increase the works, but this would pay for itself. With regard to the suggestion that a reduction of 9d. per 1000 feet be made, the Committee felt that a reduction of 5d. was all they could recommend at present.

The report having been adopted, it was agreed, on the motion of Alderman DENMAN, seconded by Alderman PLANT, that in commemoration of the purchase of the gas-works, which has turned out so valuable to the town, two of Sugg's improved lamps be placed in the Market Square.

BURNLEY CORPORATION GAS-WORKS.

We have received a copy of the gas accounts of the Corporation of Burnley, for the year ending June 30 last. These are accompanied by an analysis prepared by the Engineer, Mr. Samuel Petty Leather. They are as follows:—

Gas made	167,412,000 cub. ft.	= 9938 ft. p. ton.
Gas sold	155,899,000 ,,	= 9254 ,,
Gas used on works	1,121,000 ,,	= 67 ,,
Gas unaccounted for	10,392,000 ,,	= 617 ,,
	or 6·20 per cent.	
Coke made per ton	1,411 lbs.	
Coke sold per ton	1,095 lbs., or 77·55 per cent. of coke made.	
Coal and cannel used	16,846½ tons.	
Capital expended per ton of coal	£6 11s. 7d.	
Tar sold per ton of coal	217·80 lbs.	
Sulphate of ammonia sold per ton of coal	23·86 ,,	
Cost of coal and cannel per ton		12s. 1·595d.
Value of residuals sold		8s. 10·284d.
Net cost of coals per ton		3s. 3·312d.
Net working expenses per ton		13s. 2·176d.
Expenditure for gas per ton		16s. 5·488d.
Consumption of gas in the month of Dec. 1878	28,368,000 cubic feet.	
Ditto in June, 1879	4,766,000 ,,	

Dr.—*Capital Account, June 30, 1879.*

	Expenditure to June 30, 1878.	Expended this Year.	Total to June 30, 1879.
	£ s. d.	£ s. d.	£ s. d.
To Expenditure in purchase of old works, Jan. 1, 1855	31,299 11 11	—	31,299 11 11
Since that Date—			
Lands, &c., acquired, including law charges	4,345 2 7	3,067 12 0	7,412 14 7
New buildings, manufacturing plant, machines, storeage works, & other structures connected with manufacture	32,380 17 1	565 17 11	32,946 15 0
New mains and service-pipes, not being in place of old ones, including laying the same, paving, and other works connected with distribution	22,320 5 0	740 19 8	23,061 4 8
New meters, not in place of old ones	11,367 19 3	658 12 7	12,026 11 10
New lamps and pillars, including services and fixing	1,450 18 0	101 5 2	1,552 3 2
Sulphate of ammonia works	1,281 15 6	—	1,281 15 6
Tramway for conveying coal to works	1,279 3 6	—	1,279 3 6
Total expenditure			£110,860 0 2
Balance of capital account			3,558 10 5
			£114,418 10 7

Cr.—*Capital Account.*

	Certified Receipts to June 30, 1878.	Received during Year.	Total Receipts to June 30, 1879.
	£ s. d.	£ s. d.	£ s. d.
By Amount of loan from borough fund	45,801 11 2	—	—
Less amounts paid	1,179 18 7	—	—
	44,621 12 7	3,000 0 0	47,621 12 7
Amount of loan from Commissioners of Public Works	1,083 6 8	—	—
Less amounts paid	66 13 4	—	—
	1,016 13 4	—	1,016 13 4
Amount of surplus fund	34,503 8 11	—	34,503 8 11
Ditto depreciation (renewal) fund	29,880 4 10	1,396 10 11	31,276 15 9
			114,418 10 7

Dr.—*Revenue Account, for the Year ending June 30, 1879.*

		Cost per Ton of Coal.	Cost per 1000 Cubic Ft. Sold.
	£ s. d.	s. d.	s. d.
To Manufacture of gas—			
Coal and cannel, including carriage, unloading, and all expenses of depositing same on works	10,219 18 2	12 1·596	1 3·733
Purifying materials and wages	420 14 10	0 5·594	0 0·648
Salaries of Engineer and Assistants	586 18 3	0 8·362	0 0·903
Wages (stoking)	2,590 12 1	3 0·906	0 3·988
Maintenance of works, including renewal of retorts, machines, apparatus, tools, materials, and labour	5,067 16 4	6 0·197	0 7·802
Distribution of gas—			
Salaries of Meter Inspectors	359 6 0	0 5·119	0 0·553
Maintenance and renewal of mains and service-pipes, including materials, laying, paving, and labour	335 1 1	0 4·773	0 0·516
Repairing, renewing, and refixing meters	309 14 10	0 4·413	0 0·477
Public lamps—			
Lighting and repairing lamps	434 5 2	0 6·186	0 0·669
Rents, rates, and taxes—			
Rents	203 14 6	0 2·903	0 0·313
Rates and taxes	737 1 4	0 10·500	0 1·135
Management—			
Salaries of Town Clerk, Accountant, Office Clerks, &c.	501 14 4	0 7·148	0 0·772
Collectors	214 5 0	0 3·052	0 0·330
Stationery and printing	114 11 1	0 1·632	0 0·176
General charges and incidentals	38 1 4	0 0·542	0 0·059
Auditors	20 16 8	0 0·297	0 0·032
Total expenditure	22,154 11 0	26 3·620	2 10·106
Balance carried to profit and loss account	9,045 2 1	10 8·858	1 1·924
	31,199 13 1	37 0·478	4 0·030

Cr.—*Revenue Account.*

		Per Ton of Coal.	Per 1000 Cub. Ft. Sold.
	£ s. d.	s. d.	s. d.
By Sale of gas—			
65,561,133 cubic feet within borough, at 2s. 6d. per 1000	8,195 2 10	—	—
78,103,694 cubic feet at 3s. per 1000	11,715 11 1	—	—
425,500 cubic feet outside borough, at 4s. per 1000	85 2 0	—	—
442,796 cubic feet at 4s. 6d. per 1000	98 14 3	—	—
	20,094 10 2		
Public lighting and under contracts	2,079 19 9	26 3·904	2 10·136
	22,174 9 11		
Rental of meters	1,381 12 3	1 7·683	0 2·127
Residual products—			
Coke, less labour and cartage	2,456 10 9	2 10·997	0 3 782
Tar	2,870 1 9	3 4·888	0 4·418
Ammoniacal liquor	12 11 8	0 0·179	0 0·020
Sulphate of ammonia, less cost of manufacture, &c.	2,058 1 5	2 5·320	0 3·168
Spent lime	63 4 2	0 0·900	0 0·097
Rents	87 13 6	0 1·249	0 0·135
Sale of water	10 0 0	—	—
Profit on fittings	81 19 7	—	—
Discounts	3 8 1	0 1·358	0 0·147
Total receipts	31,199 13 1	37 0·478	4 0·030

Dr.—*Profit and Loss (or Net Revenue) Account.*

To Amount of bad debts since 1859 (written off)	£492	4	6
Interest paid on borrowed money	2,166	9	8
Amount paid for reduction of debt to borough-fund	1,179	18	7
Amount paid for reduction of debt to Commissioners of Public Works	66	13	4
Amount carried to depreciation-fund	1,396	10	11
Interest paid on consumers deposits	63	9	0
Balance carried to borough-fund revenue account for reduction of rates	3,679	16	1
	£9,045	2	1

Cr.—*Profit and Loss (or Net Revenue) Account.*

By Balance from revenue account	£9,045	2	1
	£9,045	2	1

Dr.—*General Balance Sheet.*

To Balance from capital account	£3,558	10	5
Balance from sinking-fund account	4,474	2	8
Balance from consumers deposits	1,929	5	0
Balance from sundry creditors	4,462	13	11
	£14,424	12	0

Cr.—*General Balance-Sheet.*

By Cash at Bankers	£696	3	2
Stock of coals on hand	723	4	1
Stock of sulphate of ammonia	91	15	0
Sundry stores	4,031	6	5
Office furniture	218	13	1
Gas and meter rental, due June 30, 1879	7,743	14	7
Sundry debtors	19	15	7
	£14,424	12	0

Statement of Residual Products.

—	In Store, June 30, 1878. (Estimated)	Made during the Year. (Estimated)	Used in Manufacture during the Year. (Estimated)	Sold during the Year.	In Store, June 30, 1879. (Estimated)
	Tons.	Tons.	Tons.	Tons.	Tons.
Coke	None.	10,613	2382·4	8230·6	None
Tar	None.	1638·2	None	1638·2	None
Ammoniacal liquor	None.	2184·36	1974·50	209·86	None
Sulphate of ammonia	2·80	179·50	None	176·55	5·75

Statement of Coals.

—	In Store, June 30, 1878.	Received during the Year.	Carbonized during the Year.	In Store, June 30, 1879.
	Tons.	Tons.	Tons.	Tons.
Coal	788	15,459	15,499	748
Cannel	403	1,189	1,347·5	244·5

THE ROCHDALE CORPORATION GAS-WORKS.

On Saturday, the 18th ult., a meeting of the Rochdale Literary and Scientific Society was held at the Corporation Gas-Works, on which occasion an interesting account of the progress of gas lighting in Rochdale was given by the ENGINEER (Mr. T. Ormiston Paterson), who prefaced his remarks with a brief history of the practical application of gas for illuminating purposes. The visitors were first of all shown through the different parts of the works, the machinery and appliances, as well as the various processes in the manufacture of gas, being explained by Mr. Paterson. Subsequently the company assembled in the governor-room, the chair being occupied by the MAYOR, Mr. W. J. Petrie.

Mr. PATERSON said: Mr. President, ladies and gentlemen,—On the occasion of your first visit to the Rochdale Gas-Works, I thought it might prove somewhat interesting to give a short sketch touching on the early times of practical gas lighting, and to furnish some information about the beginning and progress of gas lighting in our own town.

From the year 1792 dates the introduction of coal gas as a lighting medium on a practical and commercial basis, and it is generally admitted that all honour is due to William Murdoch, a native of Ayrshire, for this discovery. About 100 years previous to this date gas was known to exist in coal; but we have no evidence to show that any advance was made in the application of coal gas for any practical or useful purposes before Mr. Murdoch illuminated his own house in Scotland with coal gas. In 1798 he became engaged at Messrs. Boulton and Watt's works, the Soho Foundry, Birmingham. At that period his time there was partially engaged in the manufacture of steam-engines and in the erection of gas apparatus on a larger scale, and in a manner much more complete with regard to the purification, than anything he had hitherto attempted; and in 1803 a considerable portion of their works was lighted with gas. Early in 1804, Mr. Lee, of Manchester, had a small gas apparatus erected by Murdoch, in order to test its various advantages, and owing to the success of this experiment, he had, in the following year, the greater portion of the extensive cotton mills of his firm "illuminated with upwards of 900 lights." Messrs. Boulton and Watt continued the erection of gas apparatus as part of their business, and built works for several large manufacturers in Manchester, Leeds, and other places.

In the same year a new character appears on the stage, in the person of Mr. F. A. Winsor, a German. This gentleman seems to have been most enthusiastic, persevering, and energetic in introducing to the notice of the British public his discovery of gas lighting. In one of his pamphlets he says: "The thought of introducing the discovery for the advance of the British realm struck me like an electric shock;" and at the beginning of 1804, we find him exhibiting gas apparatus and lecturing on "gaslight" at the Lyceum Theatre. The results of some of his experiments are so monstrous that they are scarcely worth quoting. One grand result, however, may be given. In recommending his schemes with the view of forming a company for lighting London, he showed, by little more than a rule-of-three sum, that, by investing £5, an annual return of £570 would be given—a result calculated to raise a grave suspicion as to the accuracy of his experiments. The new invention was also to be applied in heating rooms. One tasty crystal globe on a marble pedestal was to light and heat the largest room during winter, and, speaking of illuminations, he says: "They may be carried out to the utmost extent of beauty and variegated fancy by this docile flame, which will play in all forms, submit to instant changes, ascend in columns to the clouds, descend in showers from the trees and walls, arise from the water, and even in the same pipe with a playing fountain." The residual products would also be of great value. They would be used in tanning skins, &c., and in the fabrication of white lead, &c. "But what," he asks, "are to become of our tallow chandlers and snuffer makers?" And answers that they were to become exporters. The home trade being entirely lost, other markets must be opened. The ancient lamplighters were to have new lamps and new coats, and not to annoy street passengers with dirt and train oil, and the chimney sweepers, he hoped, would get a more Christian-like employment.

In January, 1807, Mr. Winsor lighted Pall Mall with gas, and, owing to this display, a number of gentlemen met, and a company was formed. From the date of this meeting may be traced the formation of that immense undertaking called the Chartered Gas Company, who have now a called-up capital of about £9,000,000. The year 1809 is remarkable in the annals of gas lighting as being the one in which the first application was made to Parliament for an Act to incorporate a gas company, as in that year the gas company formed by Winsor, called the National Light and Heat Company, applied for power to raise a capital of £500,000, and to obtain the sole right of supplying London with gas. The application was opposed by Murdoch, aided by Watt, on the ground that they first discovered the means of manufacturing and applying gas for lighting purposes, and after a long investigation by a Committee of the House of Commons, the inquiry closed in the defeat of Winsor's company; but in the year 1812 a Royal Charter of Incorporation was granted, and the Company was called The (Chartered) Gaslight and Coke Company, the name it is yet known by.

The formation of this Company was rapidly followed by other London Companies applying for incorporation. Works were also erected in provincial towns, Birmingham, Bristol, and others. The Manchester Commissioners of Police obtained an Act in 1824—the same year that the Rochdale Gas-Works were erected—and they were also transferred from the Police Commissioners to the Corporation the same year that the Rochdale Corporation obtained the Gas-Works—viz., 1844.

With your permission, I will now give a few particulars concerning our own gas-works, but I am afraid there are many here who know more of their history than I am personally acquainted with, as the materials at my command from 1824 up to the year ending 1845 are very meagre indeed. It is unnecessary to say that, in the early years of gas lighting, the construction of apparatus, the process of manufacture, and indeed everything relating to the more extensive branches of gas engineering, was either inadequately known or altogether unknown; and the small quantity of gas obtained by distillation, being about 5000 or 6000 cubic feet to the ton of coal, together with the high prices at which it was then sold, acted as an insuperable barrier to its extended use. But the same principle applies to all our great established industries, and the difficulties attending the pioneers of gas lighting have only been overcome by practical and well-directed efforts.

The Rochdale Gas-Works were erected in 1820 by John Malam, the eminent gas engineer, at a cost of about £11,000, and if one might judge from the massive classical elevation of the retort-house, which was only removed about six years ago, many stones of which weighed nearly 5 tons, and considering that the various apparatus had been in use upwards of 40 years, they must have been of the most substantial kind when erected. The Directors were John Roby (Chairman), Thomas Booth, Samuel Lomax (Townhead), Joseph Wood (Bank), John Eckroyd (nail maker), Abraham Brierley, and John Chadwick. Mr. J. S. Lancashire was appointed Manager. It seems that the works were erected for the manufacture of gas and for coke, special coke-ovens being built; but the manufacture of this product was not long continued.

At first the works were capable of producing 20,000 cubic feet per day. At that time station-meters were practically unknown, at least in Rochdale, and I am not aware of any other works at that date measuring the quantity of gas made; but it is supposed that not more than 15,000 cubic feet of gas were consumed in 24 hours in the depth of winter. This quantity is equivalent to four minutes consumption only between the hours of four and six at the present time. The opening was celebrated by a grand balloon ascent by Mr. Sadler, who was accompanied by Mr. Roby, the day being made a general holiday in the town.

From the year 1823 to 1844 the works continued in the hands of the Company, and in the latter year they were purchased by the Corporation for the sum of £27,700. If comparisons are made in the various sections of the works as they were in 1823 and as they are to-day, it will be at once seen that vast extensions have been carried out at different periods, in order to meet the increased demand for gas. In 1824 there were only 18 retorts for carbonizing coal, and the quantity of gas produced per day from that number is given as 20,000 cubic feet, which must be for twelve hours, the quantity being so very small. At the present time there are 352 retorts, and each retort is capable of producing 5000 cubic feet of gas in 24 hours, or over 1¾ million cubic feet altogether, and it is expected that when the mills of Rochdale are again working full days, every retort will be speedily required. The quantity of coal carbonized at the commencement of the works was about 9 tons in 24 hours, and at present 150 tons are used in the same time during the winter months. Owing to this great consumption of coal, it is necessary to have large stores for stacking a reserve of from 5000 to 7000 tons, in order to guard against colliery strikes, &c. The gasholder capacity of the works in 1824 was about 36,000 cubic feet, which is only equal to about 4 feet in the depth of any of the present gasholders. The total quantity of gas that can be safely stored at the present time is rather over 1,600,000 cubic feet. In recent years gasholders have been very much improved, and the cost of erecting them considerably reduced. The telescopic form now invariably adopted gives nearly double the quantity of storeage room compared with the single-lift gasholder. The purifying apparatus of 1824 I am not very certain about, but I believe there were four purifiers, 10 feet square and about 3 feet deep. We have now twelve purifiers, six 24 feet square and 4 ft. 6 in. deep, and six 24 feet by 16 feet and 4 feet deep, and capable of purifying over 2 million cubic feet of gas per day. Exhausters, scrubbers, station-meters, and governors were unknown at the commencement of the works, but they now occupy a very prominent part in the process of gas manufacture, so much so that, if the exhausters were by any accident stopped, in numerous instances one-half of the gas made would be entirely lost; if the scrubbers were not in use, large quantities of ammonia would be allowed to remain in the gas—that is, unless it was taken out by other means; and if the station-meters were out of action, no correct record of manufacture could be kept, and neither the manager nor any one else could have much idea what the balance of profits would be at the year's end, without knowing exactly the quantity of gas and other residual products extracted from every ton of coal. Station governors were not invented for several years subsequently to 1824, and therefore the pressure of gas in the town must for some years have been regulated by a valve or tap.

The system of governing the supply of gas to Rochdale at the present time is very complete. The town is divided into three sections—viz., Central, Spotland, and Castleton—and on each supply-main to each district a station governor is placed. Each governor is regulated by water pressure, and is constructed on the safest and most approved principle. In the purifying section of the works there is an apparatus of rather a novel character. This machine is called the St. John Purifying Apparatus, and from this apparatus many marvels were expected to be achieved; but, after a very lengthened and careful trial, it has been found

that only some of the benefits claimed were confirmed; but these were of such importance as to be a sufficient guarantee for the purchase of the apparatus.

The following statement shows the increase of consumption, and the amount of mortgage debt from 1846 to 1876:—

	1846.	1856.	1866.	1876.
Money amount sold to private consumers	£5,683	£9,433	£17,832	£40,919
Money amount consumed in street-lamps	£190	£776	£1,174	£3,092
Number of cubic feet of gas made	27,919,000	62,759,000	119,003,000	241,315,000
Number of consumers	904	5,300	11,695	18,037
Number of lamps	364	519	721	1,646
Length of cast-iron main-pipes, in miles	13	29	45	68
Surplus profits paid over towards town improvements, total £90,343	1 year. £709	10 years. £13,516	10 years. £26,214	10 years. £50,613
Mortgage debt	£37,700	£41,680	£53,640	£128,529
Average selling price of gas	5s. 4¼d.	4s. 8⅞d.	3s. 11¼d.	3s. 9⅞d.

The yearly average illuminating power from 1872 up to March, 1879, both inclusive, has been: 1872, 16·77; 1873, 16·81; 1874, 18·39; 1875, 18·10; 1876, 18·32; 1877, 17·98; 1878, 17·91; and 1879, 18·00 candles—tested by the Sugg-Letheby photometer.

Mr. F. A. Collingе, the Borough Analyst, afterwards gave an instructive lecture on "The Chemistry of Coal Gas and Coal Gas Products," illustrating his observations by several successful experiments, which were highly appreciated.

The proceedings closed with a vote of thanks to both Mr. Paterson and Mr. Collinge.

TYLDESLEY LOCAL BOARD GAS-WORKS.

Mr. Thomas Newbigging, C.E., of Manchester, has just made the following report to the Chairman and other members of the Gas Committee of the Tyldesley Local Board, in reference to their gas-works:—

When I had the honour of attending your meeting, held at the board-room, Tyldesley, on the 1st of September last, you submitted the following propositions to my judgment—viz.: 1. Are the existing gas-works at Tyldesley adequate for the supply of gas, for some years to come, to the district the Board has undertaken to supply? 2. If they are, for what length of time will they last, having in consideration the rate of consumption in the past, and its probable future increase? If they are not, you are asked to advise if the works should be extended by taking land adjoining, or near to the present site; or whether it is desirable to continue the manufacture at the existing works, and erect a holder for the storeage of the gas only, on the land selected adjoining the railway near Laurel House. 4. If, in your opinion, new works are required, are the plans of works proposed to be erected on the Laurel House site such as to meet your approval in regard to the size of the proposed works in the first instance, and as to the general arrangement, so as to admit of their economical extension in the future?

I have given full consideration to these various points, and have inspected the prepared plans, and I now beg to report generally thereon.

The consumption of gas in the district has increased 120 per cent. within the past ten years. During the last five years the increase has been 48·48 per cent. It will, therefore, be safe to fix the average annual increase at 10 per cent., and to anticipate that rate for the future for some years to come. The maximum number of retorts in use at your present works during the winter has been 28. You have, altogether, seven benches of ovens, containing a total of 47 retorts, and there is no space for further extension. Deducting the usual allowance of 15 per cent. (say 7 retorts), to meet contingencies, they will serve for a period of about four years. The condenser is barely sufficient for the present maximum daily make of gas, and there is no room for extension. The apparatus is in very bad condition. The exhauster is worked up to its full capacity in the depth of the lighting season, and the same remark is applicable to the boiler, which is of very primitive construction, being fired underneath. The scrubber is of capacity large enough to answer for about three years longer. The purifiers, four in number, are exactly equal to the purification of the present maximum daily gas production. The station-meter is capable of registering correctly only 4000 cubic feet of gas per hour, and as your present maximum hourly make will frequently reach 6000 cubic feet, it follows that its capacity is 33⅓ per cent. too limited for the work. Judging by the age of this machine, and the rate at which it is driven, I should say that its internal working parts are not in very satisfactory order. The gasholders are two in number, and they are in wretchedly bad condition, both being out of the square on their vertical sides. You are supplying gas at considerable risk from these vessels. Their united working capacity is 70,000 cubic feet. The full maximum 24 hours make of gas is the usual storeage capacity, for economical and safe working, which it is considered desirable to provide in manufacturing towns such as yours. Your maximum daily production is 110,000 cubic feet. Estimated according to this rule, the capacity of the holders is too limited by 37 per cent.

It will be seen, therefore, that although your producing power is ample for four years to come, the bulk of the apparatus is either too small or only just large enough for your present requirements, whilst portions are in immediate need of replacement. In addition to this, the space at command for the storeage of coal and the residual coke is much too restricted, whilst there is no possibility of increasing it on the present site, or in any convenient situation in the vicinity. Under all these circumstances, I am led to the conclusion that it would be absolute folly to take a portion of the land on the opposite side of the road, for the mere purpose of erecting a holder. This would only be a temporary expedient, and costly beyond any advantage you would derive from it, as, after four years service (provided new works are decided upon) it would not be required. It might be argued that the additional holder, if erected, could be afterwards utilized for storeage when other works were provided; but it is always objectionable to have any portion of the storeage at a distance from the manufacturing plant, as it entails expense for superintendence, and causes increased leakage, owing to its having to be replenished with gas during the hours of non-consumption. It would be a very unwise proceeding, in my opinion, to erect a holder on the Laurel House site, a distance of over a mile away, and continue the manufacture at your existing works. To transmit the gas from the works to such a holder it would be necessary, having economy of working in view, to provide a special main-pipe of at least 12 inches diameter for the whole distance, with an exhauster at its extremity to relieve the pressure and prevent leakage. All this would involve a considerable capital outlay for results more than doubtful, and a constant expense for maintenance and labour.

The foregoing disposes of the three first clauses in my instructions. With regard to clause 4, I have no hesitation in saying that complete new works on a new site are necessary. The site at Laurel House is conveniently situated, both for the facilities it affords for the delivery of the raw material by rail and the removal of the residual products, and it is easterly to the bulk of the population. It is an unfortunate circumstance, but one to which I am aware you are fully alive, that the new site should have to be undermined by coal getting, as this may be a future source of difficulty and expense. But there appears to be, as you have assured me, no other land in the district to which the same objection does not equally apply. It might be worth your consideration to purchase the freehold, and so prevent the removal of the underlying coal.

The new site is over three acres in extent, and is capable of containing, when fully utilized, works of capacity sufficient for the manufacture, the purification, and the storeage of 1 million cubic feet of gas per diem of 24 hours. At the rate of 10 per cent. increase per annum, this production will be reached in a period of 25 years from the present time. Therefore the new site will serve, without the necessity of your acquiring fresh land, for 25 years. It is advisable, in my opinion, to construct the works in two sections, and the plans have been prepared with that purpose in view. It would, of course, be possible to construct the whole works in three different sections, and at three several times; but under such an arrangement it would scarcely be possible to provide for so large an eventual make of gas on the site, and the quantity of apparatus, as well as the number of buildings, and consequently the ultimate total cost would be increased.

Assuming, then, you have determined on having works of an ultimate capacity of 1 *million cubic feet per day*, I am of opinion that buildings and apparatus for a production of half a million cubic feet of gas per day should be provided in the first instance, as is shown in the plans submitted. These would serve for 17 years. One exception to this may be made—viz., in the size of the retort-bench. This may be erected in four sections as required, each containing four double ovens with 56 mouthpieces. The apparatus, such as condenser, exhauster, scrubber, and purifiers, &c., will all be very ample at the beginning, and for some years to come, and the first outlay will be large in proportion to the make of gas; but every succeeding year will tend to equalize the difference. Whatever is done in the way of erecting buildings and apparatus now, should be with a view to duplication in the future, and this rule has been observed in the designs supplied.

I wish it to be clearly understood that there is no insuperable difficulty in adopting the arrangement of three sectional divisions. It is, however, open to the objections I have already pointed out, and to the further minor objection that it would necessitate a slightly altered general arrangement of buildings and apparatus (the gasholders excepted), and the preparation of a new set of plans, whilst the only immediate advantage to place against these would be a saving in present capital outlay of about £3000 to £4000.

Taking into consideration the prevailing low price of material and labour, I am of opinion the works may be erected as proposed for a sum of about £22,000. I have not entered into minute constructive details, as the drawings are not complete enough to admit of that, and the instructions do not provide for my doing so; but, generally, I approve of the various designs. Under this head I make but one suggestion, viz.:—That the side walls of the retort-house should be built 21 feet high, instead of 19 feet 6 inches as at present shown. The general arrangement of the works as presented in the plans is such as could scarcely be improved. There is still another plan that might be adopted, and *it is well worthy of your consideration from the point of view of equalizing the burden of cost* —viz., to relinquish, or to occupy only a portion of the site, and erect works in two sections large enough to serve for the shorter period of 20 years. The ultimate capacity of these would be 600,000 cubic feet per day, and if constructed in two equal sections of 300,000 cubic feet each, the first would last for 12 years, and would cost about £16,000 or £17,000. Adopting this plan, you would probably decide to put down two holders of 100 feet diameter each on the site, instead of four of 90 feet diameter, as at present proposed.

In estimating the duration of the new works, I have taken the annual increase at about 10 per cent. This is undoubtedly a large increase to reckon on for 20 years to come, and, of course, should any reduction in the rate of growth in the consumption occur in the future, it would eventuate in an extension of the period for which the works would serve the district.

(Signed) Thomas Newbigging, M. Inst. C.E.

5, Norfolk Street, Manchester, Oct. 14, 1879.

THE GAS-MAKING QUALITIES OF SARDINIAN COALS.

At the Meeting of the Society of Engineers, on Monday, the 9th of June last, Mr. Charles J. Alford read a paper on the Mineralogy of the Island of Sardinia; and in the Journal of June 17, p. 936, we gave the Society's *résumé* of the paper. The full text of it has now been published.

Having reviewed the metalliferous productions of Sardinia, the Author referred to "the almost equally important one of coal." About this he said: During the year preceding the present depression of trade, when English coal, and also freight for it to the Mediterranean, commanded high prices, a great deal of interest was evinced in the subject of the coal and lignite deposits of the countries bordering on the Mediterranean, and, amongst others, the carboniferous deposits of Sardinia, the existence of which had long been known, were brought into prominence. The central position in the Mediterranean of the port of Cagliari, possessing a magnificent harbour, renders it a most appropriate place for a coaling station, and was so manifest that considerable attention was given to it, and reports on the Sardinian coal-fields became plentiful. The Author at that time went to Sardinia, to examine and report upon these coal deposits for Messrs. Docwra, who were the contractors for a railway then being made in the island. He took with him adequate boring tools and experienced English workmen, so that nothing necessary might be wanting to secure a thorough and exhaustive examination.

He then describes his search for coal, and states that having critically, examined every place where it was possible that coal formation could exist, he arrived at the conclusion that, except in the Valley of Gonnesa, there exists very little workable coal in the island, and also that all the coal which exists has been quietly formed in the bays of ancient seas, under the shelter of the more ancient rocks. The outlying portions have been denuded away by the waters which afterwards covered the beds of coal, and the strata which contain them, with alluvial deposits. In the centre of the mountains towards the east, from the village of Seui, south-east to Ulassai, there is a chain of small tertiary deposits, at a high altitude, overlying and surrounded by crystalline schists, which contain seams of coal resembling anthracite, of very fair quality, and varying from 2 to 5 feet in thickness. Their inaccessible position, however, renders them at present useless, so that, beyond a small exploration, no work has been done on them. In appearance this Sardinian tertiary coal has a certain resemblance to the true coal of the carboniferous system, being hard, compact, and perfectly black, but with a decided conchoidal fracture. It burns with a long, bright, smoky flame, and a sulphurous odour. It contains a considerable amount of gas, and leaves a soft, loose-grained coke, and not a large quantity of ash.

An analysis of a specimen of coal from the Terra di Collu Mine showed—

Carbon	41·50	per cent.
Volatile matter	48·00	
Sulphur	3·60	
Residue	6·90	

By the kind permission of the Secretary of the Company, some comparative experiments were made with this coal at the Fulham Gas-Works, of which the following is the result:—

Result of Experiments made with Sardinian Coal, Compared with a Scotch and two English Coals.

	Sardinian.	Scotch.	Newcastle.	Lancashire.
Cubic feet of gas, per ton	9,500	8,900	10,200	12,500
Coke, per cent.	56	58	67	65
Heating power, units	12,493·64	12,764·40	12,986·00	13,296·65
Specific gravity	1·202	1·275	1·265	1·240
Ash in coal, per cent.	6·47	9·16	4·20	5·44
Ash in coke, per cent.	11·50	14·18	6·50	8·06
Sulphur in coal, per cent.	3·35	2·64	1·50	2·00
Power of gas, candles	15·00	16·00	16·00	20·00

The experiments from which the above table was formed were conducted with every care, and the result may be taken to establish the value of the Sardinian coal as compared with the others; but it must be remembered that the sample used was a very good one, and also that laboratory experiments will always give better results than can be expected in actual practice. The value of the coal as a marketable article depends on its proportionate value as compared with the English coal with which it has to compete. As a gas coal, though it contains a large amount of gas, it is nearly useless, on account of the quantity of sulphur it contains. A trial of it made in the gas-works at Cagliari had most unpleasant results.

WATER GAS: ITS HISTORY AND MANUFACTURE.

By Professor Henry Morton, Ph.D.

[From the New York *Plumber and Sanitary Engineer*.]

No. I.

The title "water gas" might, with equal propriety, be applied to several very different substances—as, for example, to steam, which is water in a gaseous state; hydrogen, the gas which, as its name implies, forms water; and to some other gases which have a more or less direct association with water; but of late years this term has acquired a very special and technical signification, and it now indicates a gaseous mixture, which may vary between very wide limits in its composition, but must at least fulfil this condition—that it is in part derived from the decomposition of water by carbon, or some such hydrocarbon as bituminous coal, coal tar, petroleum, or the like. Still more specifically, the term "water gas" is understood to distinguish any illuminating gas in the manufacture of which the decomposition of water plays a prominent part, from the illuminating gas produced solely by the decomposition of bituminous coal, wood, resin, tar, oil, or other like material.

Recently much attention has been directed to the production of such "water gas" as that last indicated, by several processes, or modifications of a common process, on the ground that a much better and cheaper source of light, for domestic and public uses, could be thus supplied; and it is for this reason that the present writer has undertaken to collect and present some of the facts—historical, scientific, and explanatory—connected with the subject.

In the first place, as to the elementary chemical principles involved.

When steam is brought into contact with ignited carbon, in the form of charcoal, anthracite, or the like, the steam (which consists of two volumes of hydrogen gas united with one volume of oxygen, and so condensed by the union as to form two in place of three volumes) is decomposed. Its oxygen combines with the carbon to form carbonic oxide (CO), or carbonic acid (CO_2), or a mixture of the two, in proportion depending upon the relative quantities of steam and carbon which can act on each other, the temperature, and other conditions. If great excess of ignited carbon be present, the product will consist mainly of hydrogen and carbonic oxide; if the steam is in excess and the temperature high, steam and carbonic acid will be the chief products.

Intermediate results might be expected in most practical operations, and, moreover, impurities in the material used, such as sulphur and iron in the coal, air accidentally or of necessity introduced, corrosion, or rather oxidation of iron retorts, may be expected to modify the results, even on theoretic grounds. Such variations are indeed observed in practice, and are of a very marked character. Thus, a series of experiments, made by Mr. G. Howitz, Manager of the Copenhagen Gas-Works, Denmark, showed that the gas produced by decomposing steam by coke in an iron retort had the following percentage composition:—

Hydrogen	60
Carbonic oxide	20
Carbonic acid	20
	100

A water gas made at New Haven showed, by analysis of Professors Silliman and Würtz, the following percentage composition:—

Hydrogen	56·5
Carbonic oxide	36·0
Marsh gas	3·5
Nitrogen	4·0
	100·0

Theoretically, 15·8 lbs. of pure carbon and 23·5 lbs. of water would make 1000 cubic feet of gas, half hydrogen and half carbonic oxide; or, 10·5 lbs. of carbon and 31 lbs. of water would make 1000 cubic feet of a mixture in which two-thirds, by volume, was hydrogen and one-third carbonic acid. Where a mixture of hydrogen, carbonic acid and carbonic oxide was produced, the theoretical proportions of the materials would be intermediate between these extremes. Thus, such a mixture as that obtained by Mr. Howitz would require 12·7 lbs. of carbon and 2·85 lbs. of water for each 1000 cubic feet of gas produced.

It must, however, not be forgotten, that, in the first place, coal is not pure carbon, and, in the second, that the coal involved in the chemical reaction above noticed is but a small part of what is required to produce the result, the main expenditure being in fuel to develop and maintain the temperature, and supply the heat energy by which these reactions are brought about. The most reliable statements on this subject seem to show that about 100 to 150 lbs. of coal are actually used in the production of each 1000 cubic feet of water gas by the various processes heretofore developed.

Hydrogen and carbonic oxide are both combustible gases, which yield large amounts of heat on burning. Carbonic acid, on the other hand, not only does not itself burn, but interferes greatly with the burning of other bodies. Carbonic acid, if formed to any extent, must therefore evidently be removed from the products of this reaction, if that product is to be used for heating or lighting in any way. This can be done by passing the gases over moist lime, which absorbs the carbonic acid rapidly. This involves, however, a considerable expense, both for material used, and for various items of cost in application, such as labour in handling lime, loss in changing (emptying and refilling) purifiers, &c.; so that, if all the carbon taken up were in the form of carbonic acid, and this was removed by lime, the process would become very expensive. In this case, also, it must be remembered that the product would consist only of hydrogen, and would have a volume only equal to that of the steam decomposed. If all the carbon is present as carbonic oxide, the volume of the product will be, theoretically, just twice as great as if the hydrogen alone is obtained as a final result.

The heating effects of the two gases, hydrogen and carbonic oxide, are as follows:—1 lb. of hydrogen, in burning, will develop heat enough to raise 62,032 lbs. of water 1° Fahr.; 1 lb. of carbonic oxide, in burning, will develop heat enough to raise 4478 lbs. of water 1° Fahr.

Evidently a mixture of hydrogen and carbonic oxide would constitute a very efficient fuel. What its economy would be, as compared with the coal employed in producing it, is, however, another matter. The exact relations of this I do not propose here to discuss, but would call attention to the following elementary principle:—The doctrine of "conservation of energy" teaches us that a cycle of changes, ending where it began, cannot render any energy available, but must leave things where it found them in this respect, except in so far as loss by the scattering of energy into surrounding bodies may have occurred. Thus, if we decompose water by means of ignited coal, there will be just as much heat withdrawn from the apparatus by that act of decomposition, as the liberated combustibles can produce by again burning. Great loss may, and will occur by the transfer of heat to surrounding objects and into space, and thus the combustible gases produced can have only a fraction of the total heating capacity originally residing in the coal. Their convenience of application may, and in certain cases does give them a great economic value, but this we must, of course, credit to its true source. This is, perhaps, quite a superfluous statement to most of my readers; but, for the sake of leaving no chance of a misunderstanding, I have ventured to make it.

Besides its application to heating purposes, such a mixture of combustible gases as I have above described admits of another extended use—namely, for illumination; for, though not itself capable of producing light in burning, it may serve as the requisite vehicle and fuel to develop light from such dense hydrocarbon gases and vapours as are generally recognized as the "illuminants" in coal gas.

Thus, the mixture of carbonic oxide and hydrogen, produced as above described, by passing steam into a mass of ignited coal, may be mixed with a very dense gas, such as is obtained from resin or oil, and which would, alone, burn with a smoky flame, and thus may produce an illuminating gas similar to that obtained by the distillation of bituminous coal in the usual manner.

This will be the better understood if I give, in the first place, some notion of the chemical composition of ordinary illuminating gas made from the usual varieties of bituminous coal. I will give the results of several analyses in a tabular form, so as to convey a clear notion of the common range of variation in the composition of ordinary coal gas.

Analysis of Ordinary Coal Gas.

Constituents.	Authorities.			
	Bunsen.	Roscoe.	Sutton.	Letheby.
Carbonic acid	3·01	3·67	1·772	0·60
Oxygen	0·65	H_2S ·29	0·142	0·10
Dense hydrocarbons, or "illuminants"	5·09	6·46	4·906	3·80
Carbonic oxide	8·88	6 64	5·684	7·50
Hydrogen	46·20	45·58	46·952	46·00
Marsh gas	34·02	34·90	38·122	39·50
Nitrogen	2·15	2·46	2·361	0·50
Water	—	—	—	2·60
	100·00	100·00	99·999	100·00

Of the above constituents, the first two and the last may be regarded simply as impurities, accidentally present, but all exerting an unfavourable influence upon the light-producing properties of the gas. The third constituent, dense hydrocarbons or illuminants, also often designated as "olefines," really represents a mixture of olefiant gas (C_2H_4) with acetylene (C_2H_2), benzole (C_6H_6), and other hydrocarbons rich in carbon, and burning, when alone, with a dense and often smoky flame. They are all grouped together in one item in ordinary gas analysis, because they are assumed to act all alike in giving luminosity to the flame, and are conveniently determined together, because they are all alike absorbed by fuming sulphuric acid or by bromine.

The next constituent, carbonic oxide, may be called an impurity, and a very objectionable one, in coal gas, being, no doubt, the chief cause of the poisonous effects produced by illuminating gas when inhaled; but, for reasons which will appear presently, it cannot be dismissed with the other impurities, but must receive a large share of notice. In coal gas, however, it is usually present only in small amounts, as is shown in the table; and thus, except for its poisonous influence, would be of little importance to the properties of the mixture.

The next constituent, hydrogen, forms, as will be observed, one of the largest items in each analysis. It burns alone with a non-luminous flame, and thus acts only as a vehicle and fuel to carry the heavy illuminants, and to aid in heating them up to a bright incandescence.

Next we have marsh gas, so called because it is formed sometimes where vegetable matter decays under water, and may therefore be found in bubbles at the bottom of stagnant pools and in marshes; it is also called light carburetted hydrogen; also, in chemical nomenclature, "Methane." This gas, though containing some carbon (its composition is CH_4), burns alone with a non-luminous flame, like hydrogen; but there is this difference: If we add the same quantity of an "illuminant," say benzole, to hydrogen and to marsh gas, and burn them, the amounts of light will be as 69 to 92. In other words, though marsh gas gives no light itself, it detracts nothing from the luminous effect of the "illuminant," while hydrogen, on the contrary, does to the extent of about 25 per cent. In other words, hydrogen, in comparison with marsh gas, is a sort of *negative illuminant*.

Carbonic oxide is also similarly a negative illuminant to the extent of about 20 per cent. See experiments by Frankland and Thorne, *Chemical News*, Jan 25, 1878.* In these it appears that—

One cubic foot of benzole vapour burned with hydrogen, gave for one hour the light of	69·71 candles.
Ditto, with carbonic oxide, gave for one hour the light of	73·38 „
Ditto with marsh gas (first series), gave for one hour the light of	92·45 „
Ditto with marsh gas (second series), gave for one hour the light of	93·94 „

It is evident from the above that, starting with a mixture of hydrogen

* See Journal, Vol. XXXI., p. 167.

and carbonic oxide as a basis, in order to produce an illuminating gas, we must add in some way considerable quantities of dense hydrocarbons, such as olefiant gas, benzole, and the like, or their equivalent.

Among the methods of doing this, evidently would be the mixing of such gases as those derived from oil, tar, resin, and the like, which are excessively rich in illuminants.

The following table will show the actual composition of some of these rich gases :—

Constituents.	Oil Gas. (A. Würtz.)	Petroleum Gas. (Wagner.)
Carbonic acid	—	0·20
Oxygen	—	—
"Olefines" (illuminants)	38·00	25·30
Carbonic oxide	—	6·65
Hydrogen	3·0	3·05
Marsh gas	56·5	64·80
Nitrogen	2·5	Traces.

Another method would be to charge the water gas, or mixture of hydrogen and carbonic oxide, with vapours of some cheap volatile hydrocarbon liquid, such as naphtha, and thus carburet it, or supply the required dense hydrocarbons. Many other methods might be here enumerated, but it will be best to discuss them in connection with the actual history of this branch of industry.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

As I anticipated in my previous report, there is an upward tendency in the coal market of this locality, and advances have this month been made in some districts. But the movement has not been so general as had been anticipated, and there is a want of firmness about it which would indicate some doubt as to whether the higher prices which are being asked can in all cases be maintained. There is, however, a considerably better demand for all classes of round coal, and from some districts very large quantities have been going away during the last few weeks; but there is still no actual scarcity of supplies in the market, and many of the pits have not yet got into full work.

In the Manchester district the advances which were announced last month by one firm, and which were only partially followed by others, have now become general, and, both for delivery in Manchester and in the outside districts, there is an advance of from 5d. to 10d. per ton upon all descriptions of round coals, with also some slight advance in the pit prices; but in engine classes of fuel the advance has only been very irregular.

In the important colliery district of which Wigan is the centre, it was thought that some general advance would be made, and a meeting of colliery proprietors was held to consider the matter; but no united action could be decided upon, and it is only from a few of the collieries that notices of an advance of 6d. to 1s. per ton have as yet been sent out.

Engine classes of fuel, such as burgy and slack, are generally without any material improvement throughout Lancashire, and there is but little difficulty in securing forward contracts at present rates.

The average quoted prices at the pit mouth may be given about as under:—Best Wigan Arley, 8s. 6d. to 9s. per ton; common qualities, 6s. 6d. to 7s. 6d.; Pemberton four-feet, 6s. 3d. to 6s. 9d.; common round coal, 4s. 9d. to 5s. 6d.; burgy, 3s. 6d. to 4s. 3d.; good slack, 2s. 6d. to 3s. 3d., and common about 2s. per ton.

For coke there is more inquiry, and prices have a tendency to harden, although they are not materially higher.

There is a lull in the demand for iron, and although makers, having little to sell, at present are firm in maintaining their full prices, there is a considerable amount of underselling going on in the market. For Lancashire pig iron the quoted prices remain at 53s. per ton for No. 3 foundry, and 52s. for No. 4 forge, less 2½ per cent., delivered into the Manchester district, and for Lancashire bars about £6 10s. per ton.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The shipments of gas coals were much better last week than the week before. The only noticeable drawback was the need of small sailing vessels to load for Irish gas-works; for, though unusually high rates of freight were offered to masters to charter thence, they did not come forward. Some orders have been in the market nearly a month. The supply of small sailers for the eastern counties and for the Channel ports has been pretty ample; at the same time more money has had to be paid per ton to secure them. Where an odd steamer or two have been needed to load gas coals for London and the larger ports of the United Kingdom, or for the North of France, the shipper has had to make a rise in rates. At present coal freights are higher all round. The revival of trade is drawing into employment tonnage from Spain with ore and other businesses of the like kind. It is probable, therefore, that freighting will continue strong coastwise until the close of the Baltic season, when there will be a better choice of steamers to carry coals.

The best gas collieries are working very well. They are employed at full time. Small and manufacturing coals are being brought up in price to be a help to round coals. The manufacture of coke having increased materially, a quantity of small coal is passing into local consumption; for, not only is more small coal needed for coke-making, but the chemical and other factories are showing a large increase in their production, and a consequently much increased consumption of inferior qualities of coal.

Pretty large contracts have been entered into in October for the supply of steam coal next year, at an advance of from 6d. to 1s. per ton. Coke has been in better demand for Spain and Africa, and also for the Baltic.

There is no special improvement to note in the manufactured iron trade. A great deal of crude iron has been, and is being shipped to the United States. But very small quantities of manufactured iron have been sold or sent abroad. The chemical market had a wonderful lift in October. Crystals of soda and bleaching powder have had a rise of fully £1 a ton over the month. A good deal of business has been done in this trade for delivery over next year at the advance mentioned. Sales of Greek lead took place last week; 335 tons realized £15 12s. 6d., and 60 tons of refined lead were sold at £16 5s. per ton. Red lead is selling in the Tyne at £18 a ton. There is a fair demand for lead pipes in the Tyne for shipment. Metal and sanitary pipes, with fire-clay goods, find a pretty steady market.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

At the final meeting of the Town Council of Aberdeen prior to the November elections, held on Wednesday, the Gas Committee submitted an abstract of the revenue and expenditure account in connection with the gas supply undertaking, and recommended that the price of gas should be reduced from 4s. 3d. to 4s. 2d. per 1000 feet. Bailie Donald, the Convener of the Gas Committee, said, in reference to the recommendation, that the proposed reduction might be looked upon as a very small one; but it had to be borne in mind that since the Town Council took over the gas-works in 1870, the price had been reduced from time to time to the extent of 1s. 3d. per 1000 feet. The price stood at 5s. 5d. in 1870, now it was 4s. 2d. Notwithstanding the reductions in price, there had been an increase of the plant and an improvement of the works, while the quality and illuminating power of the gas had been fully maintained. He concluded by asking the Council to relieve him of the duties of Convener of the Committee, and took the opportunity of stating his conviction that they could not have a better or more efficient servant than Mr. Alexander Smith, the present Manager of the gas-works. The report of the Committee was adopted, and Bailie Donald's resignation was accepted, a hearty vote of thanks being, on the motion of Bailie Ross, accorded to him for his valuable services as Convener.

By way of supplement to the foregoing, it may be mentioned that Professor Brazier, who has inspected the quality of the gas as supplied by the Aberdeen Town Council, reports as follows for the past six months:—

Visits made.	Mean Observations.
April 15	30·35 candles.
May 10	30·02 "
June 7	30·40 "
June 28	30·40 "
Aug. 29	30·55 "
Sept. 29	31·07 "

During the past six months the gas has been remarkably free from the ordinary impurities of ammonia, sulphuretted hydrogen, and carbonic acid. The illuminating power of Aberdeen gas is certainly very high; I am not sure that it is not the highest of any gas in Scotland.

As a proof of the present prosperity of the Brechin Gas Company, it may be mentioned that the Company's old shares recently changed hands at £24 per £10 share, and the new ones at £12. It is alleged that the only difference is that the new shares are for the current year entitled to only half a year's dividend, and that the difference, therefore, in the market price ought not to be so much as that mentioned.

At a meeting of the Burntisland Gas Commissioners, held last Tuesday evening, it was resolved to continue the former charge of 6s. 8d. per 1000 cubic feet of gas for the next half year, so that the Commissioners may be able to form an idea of the revenue, with the object of making a reduction in price to the consumers, if that is at all practicable.

One of Sugg's patent gas-lamps has at last been erected in Greenock, the site chosen for it being Cathcart Square, which is probably the most public place in the town. It was lighted up on Friday evening for the first time, when it gave forth a good flame, and illuminated the square with a clear and steady light. The lamp, which is fitted with a Sugg Argand burner, has been temporarily erected, but if the light is approved of the reflection will be properly adjusted, and a suitable column and lamp placed permanently in the square.

The Police Commissioners of Annan held a special meeting on Thursday night, to consider a report by Messrs. J. and A. Leslie, of Edinburgh, criticizing a report by Mr. Gale, C.E., of Glasgow, on a water supply for Annan. Mr. Gale recommended a supply being obtained by gravitation from the Kirk Burn, at a probable cost of £15,000. Messrs. Leslie state that if a gravitation scheme is resolved on, they recommend Middlebie Burn as a more suitable and less expensive source; but they express themselves in favour, on account of its great economy, of pumping water from the River Annan, a little above the town. They estimate the annual cost of the Kirk Burn gravitation scheme at £1300, and that of the pumping scheme at only £550. On account of the approaching municipal elections, it was resolved to let the report lie on the table.

On Wednesday last the extension water scheme of Alexandria was successfully completed. The works, which were commenced at the end of May, are situated about half a mile westward of the village, at an elevation of fully 100 feet above the level of the main street. In form the reservoir is square. It is enclosed on three sides by strong embankments of considerable height and thickness, and it covers an area of 3½ acres. In the centre of the embankment is a puddle wall of great dimensions, which will render the sapping of the embankment foundation an impossibility. The reservoir is capable of containing 5 million gallons. Attached to it is a large filter capable of passing 150,000 gallons per day. The estimated cost was £2450, and for pipeage £600. The actual cost, exclusive of pipeage, is £2300. The engineer was Mr. J. Wilson, C.E., of Greenock.

There have again been sharp fluctuations in the Glasgow pig iron market during the week, with a large amount of business done daily. The close prices on Friday afternoon were—buyers, 52s. 9d. cash and 53s. 1½d. one month, sellers asking 1½d. per ton higher. Makers prices were several times reduced, but without stimulating buying, which is for the present almost completely off.

The coal market has not undergone any material change in demand, and an effort to reduce the wages of the miners has been commenced.

Register of Patents.

APPLICATIONS FOR LETTERS PATENT.

4340.—WILLIAMS, H., Southport, Lancs, "Improvements in and relating to atmospheric air and gas motor engines." Oct. 24, 1879.

4354.—HICKLEY, A. S., Catford Bridge, Kent, "Improvements in or applicable to electric lamps." Oct. 25, 1879.

4377.—BUTCHER, J. J., Gateshead, Durham, "Improvements in gas motor engines." Oct. 27, 1879.

4392.—ROSS, I., Edinburgh, "Improvements in the construction of hydrants." Oct. 29, 1879.

4405.—NEWTON, A. V., Chancery Lane, London, "Improvements in electric lamps." A communication. Oct. 29, 1879.

4414.—HERON, T., Manchester, "Improvements in gas-burners." Oct. 29, 1879.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

1700.—TURNER, J., Walworth, London, "Improvements in dry gas-meters." April 30, 1879.

1733.—RIPLEY, R. S., Strand, London, "Improvements in the treatment of illuminating gas, and in apparatus therefor." A communication. May 1, 1879.

1931.—FOULGER, G. F. L., Bow, London, "Improved means and appliances to be used in connection with gas-meters for preventing the fraudulent or unregistered consumption of gas." May 14, 1879.

2422.—HORSLEY, C., Highbury New Park, London, "Improvements in apparatus used in the distribution of gas." June 18, 1879.

PATENT WHICH HAS BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

2814.—KING, R., "An improved gas regulator, which may also be used to regulate the flow of water and other fluids." Sept. 24, 1872.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, TWO MEDALS at the PHILADELPHIA EXHIBITION and TWO MEDALS at the PARIS EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

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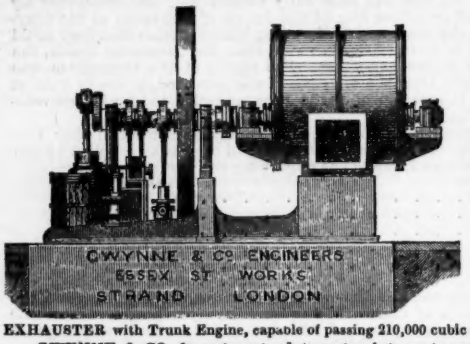
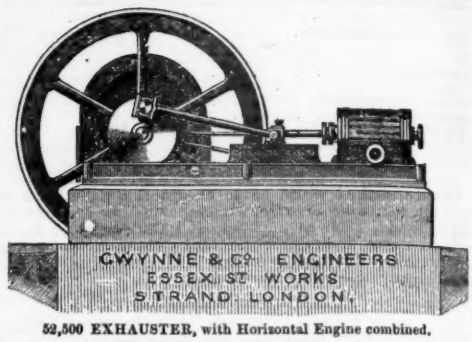


EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"*Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship.*"

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 8,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



52,500 EXHAUSTER, with Horizontal Engine combined.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas WITHOUT OSCILLATION OR VARIATION IN PRESSURE Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, GWYNNE & CO., Hydraulic and Gas Engineers, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

Gwynne & Co.'s New Catalogue on Gas-Exhausting and other Machinery may be obtained on application at the above Address.

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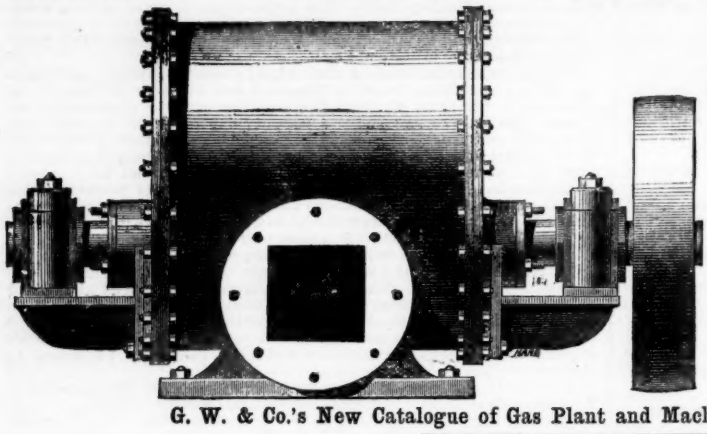

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WROUGHT-IRON SPINDLES AND
ENGINES COMBINED.

GEORGE WALLER & CO.,
MAKERS OF
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HYDRAULIC MAIN VALVES,
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TAR, LIQUOR, AND OTHER PUMPS,
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CONDENSERS, BOILERS, &c.

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ECONOMY IN THE PRODUCTION OF GAS.

PLUTONIC CEMENT,

FOR JOINTING AND REPAIRING RETORTS AND OVENS *in* ACTION AND *out* OF ACTION.

A Pamphlet on the advantages of the above, with Modes of Application, References, Prices, &c., free by post, from the Sole Manufacturer,
WILLIAM RICHARDSON, Gas and Hydraulic Engineer, CHARLES HENRY STREET, and BISSELL STREET, BIRMINGHAM.

Now Ready, Handsomely bound in Morocco gilt, cloth sides, gilt edges, Vols. 1 and 2 of

KING'S TREATISE
ON THE
SCIENCE & PRACTICE OF THE MANUFACTURE & DISTRIBUTION
OF
COAL GAS.

EDITED BY THOS. NEWBIGGING, C.E., M. INST. C.E., AND W. T. FEWTRELL, F.C.S.

VOL. I. contains 460 pages of Letterpress, and is illustrated by 521 Woodcuts and 36 page and double-page Engravings, printed on Plate paper, and a full-page COLOURED ENGRAVING of the BECKTON GAS-WORKS, forming a frontispiece to the Work.

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Price of each Volume, 28s.

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WANTED, Readers of the NEW Edition, 1879, "Cooking & Heating by Gas;" on Burners, &c. Copies, by post, Threepence, direct from the Author, MAGNUS OHREN, Assoc.M.I.C.E., Gas-Works, SYDENHAM.

THE Manager of the Oxford Gas-Works begs to recommend a steady middle-aged man as Fitter, Main and Service Layer, or to take sole charge of a small Works.

DRAUGHTSMAN, Mechanical, of five years experience in Gas-Works, seeks Employment in London or Suburbs.
Address G T. H., 11, Park Road Terrace, FOREST HILL.

WANTED, an Engagement as Meter Repairer, Smith, Plumber, &c. Well used to Engines and Machinery. Can do the general repairs of the Works, or Manage small Works.
Address A. HUGHES, 300, Bridge Street, West Hockley, BIRMINGHAM.

WANTED, by the Advertiser, a Situation as MANAGER or ASSISTANT MANAGER of a large Tar Manufactory. Large experience and satisfactory reference.
Address No. 600, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for New Zealand, a good RETORT SETTER; two years engagement.
Apply, by letter only, to No. 601, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Advertiser, a Situation as MANAGER or ASSISTANT MANAGER of a large Works. Has had every experience in a Gas-Works. Satisfactory reasons for wishing to change. Good references and testimonials.
Address No. 589, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

DRAUGHTSMAN wanted at the Reading Gas-Works. Must be thoroughly well up in the various requirements of a Gas-Works. None others need apply.
Apply, stating age, references, salary required, to Mr. E. BAKER, Engineer.

COMMERCIAL GAS COMPANY.

THE Directors are prepared to receive Applications for the vacant office of SECRETARY. Candidates to apply in writing, with testimonials and references, addressed to the Secretary, *pro tem.*, at the Offices of the Company, Stepney, E., on or before Nov. 20, 1879.
Personal canvass of Directors not permitted.

TENDER FOR PIPES.

WANTED, by the Sevenoaks Gas Company, the under-mentioned PIPES, viz.:—
4000 yards = 1334, 6-in. socket-pipes, to weigh. per pipe, 2 cwt. 1 qr. 14 lbs.
1000 yards = 333, 5-in. socket-pipes, to weigh, per pipe, 1 cwt. 3 qr. 7 lbs., with a small quantity of Connections of each size.
The above pipes are to be 9 ft. 4 in. long, of equal thickness throughout; to be clean, solid castings, and each pipe to be tested up to 100 lbs. on the inch.
Tenders to state price per pipe of each size, and connections at per cwt., delivered free to the Bat and Ball or Tub's Hill Stations at Sevenoaks, Kent.
Contractor is required to state in his tender if the pipes are ready for immediate delivery, or how long he will require to deliver half the 6-in. pipes, and how long the remainder; also, where the pipes will be cast.
Payments will be made after delivery, on the certificate of the Company's Engineer, Mr. Alfred Penny, 20, Abingdon Street, Westminster, who will furnish any further information that may be required.
Tenders to be sent not later than the 10th of November, addressed EDWYN CRONK, Esq., Chairman, Gas Office, SEVENOAKS.

FOR SALE—Two large Boilers, made purposely for sulphate ammonia making, nearly new; made on the Waggon principle. Length about 22 ft.; wide, 6 feet on the crown of the boiler; depth about 5½ feet, with fittings. Having to dispose of them, contract ended.
Address WM. WORSLEY, Oil, Grease, and Manure Works, WIGAN.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.
Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.
Patents procured for Foreign Countries.
Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 22, Great George Street, WESTMINSTER.

GAS MANAGER WANTED.

IN consequence of the resignation of their present Manager, the Ballinasloe Town Commissioners are prepared to receive Applications from persons desirous of the above.
The person appointed must give his entire time to the concern; must thoroughly understand the management of the Works, Laying of Mains, Setting Retorts, Repairs of Meters, and taking their indications, &c.
Emoluments, £80 a year, with house on the gas premises, fuel, light, and a small garden. The situation will become vacant on Dec. 1, 1879, on which day the person appointed will have to take charge.
Proposals, addressed "The Chairman, Town Commissioners, Ballinasloe," will be received up to Nov. 11, 1879, on which day they will be considered. Candidates to state their ages.

By order,
EDWARD STEACIE, Town Clerk.
Board Room, Ballinasloe, Oct. 28, 1879.

ELLAND GAS COMPANY.

FOR Sale at these Works, Two Second-hand SCRUBBERS with 10-in. Connections in good condition, 16 ft. high by 5 ft. 6 in. in diameter, filled with boards, &c., complete. Will be sold cheap.
Any further particulars may be obtained on application to W. A. WALKER, Secretary and Manager.

TO BE SOLD, Cheap, Three Telescopic GASHOLDERS, two 60 ft. diameter and 20 ft. deep each lift, and one 70 ft. in diameter and 20 ft. deep. Only been in use eight years. May now be seen at work at the Effingham Street Gas-Works, Sheffield.
For price, apply to THOMAS PIGGOTT AND CO., Spring Hill, BIRMINGHAM.

TANKS.—Several stout square wrought-iron TANKS, from 2000 to 3000 gallons, suitable for Tar, Anthracine, Oil, &c., are for Sale, cheap. Also several Pressure Boilers, 6 ft. by 4 ft., suitable for Benzole or Naphtha, Rectifying, &c.; Office Furniture, Platform Weighing-Machine, and Sundries.
Address No. 602, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SIX POUNDS PER CENT. DEBENTURES FOR SALE.

TO be Sold at Par, £4000 of First Mortgage Debentures, in sums of £100 and upwards, in the English Company of the Buenos Ayres Gas Company, Limited. The debentures have about eight years to run, and the coupons are paid in London with the utmost regularity.
Address No. 598, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO CHEMICAL MANUFACTURERS, TAR DISTILLERS, AND OTHERS.

THE Directors of the Shipley Gaslight Company are prepared to receive TENDERS for the Purchase of their Surplus TAR and AMMONIACAL LIQUOR for One year from Jan. 1, 1880.
The Company will load f.o.b. the Leeds and Liverpool Canal, at Shipley, or into the Contractor's carts at the Works.
The quantity of Coal carbonized in Twelve months is about 8000 tons.
Any further information can be had on application to the Manager.
Sealed tenders (stating separately price per ton for Tar and Liquor and endorsed "Tender for Tar, &c.") to be sent in on or before Nov. 11, 1879.
JOHN WILCOCK, Manager.
Gas-Works, Shipley, Oct. 24, 1879.

LEICESTER CORPORATION WATER-WORKS.

CONTRACT NO. 3.

THE Water-Works Committee of the Corporation of Leicester are prepared to receive TENDERS for the Construction of two additional FILTER BEDS, and other works connected therewith, at their Bradgate pumping station near Cropston.
Drawings and specifications may be seen at the Water-Works Office at Leicester, and at the Office of Messrs. T. and C. Hawksley, Civil Engineers, 30, Great George Street, Westminster, S.W., on and after Monday, the 27th of October inst., where copies of the bills of quantities may be obtained on payment of one guinea, which sum will be returned if a *bona fide* tender be made.
Tenders, duly sealed and endorsed "Tender for Filter Beds, &c." must be delivered at my Office on or before Ten o'clock in the forenoon of Monday, the 17th of November next.
The Committee do not undertake to accept the lowest or other tender.
JOHN STOREY, Town Clerk.
Town Hall, Leicester, Oct. 21, 1879.

GAS LIGHTING IMPROVEMENTS.

GEO. BRAY & CO.'S NEW PATENT LANTERNS.

See Page 715.

IMPERIAL CONTINENTAL GAS ASSOCIATION.
(INCORPORATED BY ACT OF PARLIAMENT.)
NOTICE is hereby given that the HALF-YEARLY ORDINARY MEETING of the PROPRIETORS of the Imperial Continental Gas Association will be held at the City Terminus Hotel, Cannon Street, London, on TUESDAY, the 25th inst., at Two o'clock in the afternoon precisely, when a report will be made to the Proprietors, a Dividend declared for the half year ended June 30, 1879, and the usual ordinary business of such meeting transacted.
Notice is hereby also given that the Transfer Books will be closed on Tuesday, the 11th inst., and will remain closed until after the Half-Yearly Ordinary Meeting on the 25th inst.

R. S. GARDINER, Secretary.
By order of the Board.
30, Clement's Lane, Lombard Street,
London, E.C., Nov. 3, 1879.

THE GASLIGHT AND COKE COMPANY.

SALE BY TENDER OF £100,000 ORDINARY "A" CONSOLIDATED STOCK.

IN pursuance of The Gaslight and Coke Company Act, 1876, notice is hereby given, that it is the intention of the Directors of this Company to SELL by TENDER £100,000 of NEW ORDINARY "A" CONSOLIDATED STOCK of the Company, to be paid up in full on or before the 1st of December next, such Stock being the second portion of additional capital authorized to be raised by resolutions passed at a General Meeting of Proprietors, held on Feb. 14, 1879, under the provisions of the above-mentioned Act.
Particulars and conditions of tender may be obtained on application at this Office, and sealed tenders must be sent in not later than Twelve o'clock (noon) on Friday, the 7th of November next.

By order,
JOHN ORWELL PHILLIPS, Secretary.
Chief Office, Horseferry Road, Westminster, S.W.,
October, 1879.

THE Gloucester Gas Company, ceasing to manufacture gas at their old works, will have the undermentioned APPARATUS for Sale about the beginning of August, viz.:—
110 Mouthpieces, D-shape, 13 in. by 22 in., with Wrought-Iron Lids, Cross-Bars, Stand, Bridge, and Dip Pipes. Also about 150 feet of D-shape Wrought-Iron Hydraulic Main, size 19 in. by 19 in. 28 Mouthpieces, D-shape, 16 in. by 20 in., with Wrought-Iron Lids, Cross-Bars, Stand, Bridge, and Dip Pipes. Also about 38 ft. of D-shaped Wrought-Iron Hydraulic Main, size 20 in. by 20 in. Annular Condenser, consisting of six Vertical Pipes, 24 in. diameter, 19 ft. high, with three 12 in. Slide-Valves and 12 in. Connections.
Scrubber (round), 5 ft. by 20 ft., with three 12-in. Slide-Valves, and 12 in. Connections.
Exhauster (Jones) to pass about 15,000 feet per hour.
Exhauster (Beales) to pass about 25,000 feet per hour.
Two Vertical Steam-Engines, each about 6-horse power, with Pulleys, and Shafting used for driving the above.
Boiler 14 ft. 6 in. by 3 ft. 6 in., with Centre Tube, and four Galloway Patent Tubes.
4-horse power Horizontal Steam-Engine.
Three 4-in. Pumps, with cranked Shafting and a pair Mitre Wheels.
Set of four Purifiers, 12 ft. by 12 ft. by 4 ft., with 12-in. Centre-Valve (Cockeys), and Connections and Lift complete.
Station-Meter by A. Wright and Co., London, with three 12-in. Slide-Valves, and 12-in. Bye-Pass and Connections, to pass about 25,000 feet per hour.
Gasholder, Double Lift, with Cast-Iron Tank, capacity 37,000 feet.
Gasholder, Double Lift, capacity 100,000 feet.
Gasholder, Double Lift, capacity 240,000 feet.
Two 12-in. Governors, by Wright, London, with 12-in Valves, Bye-Pass, and Connections.
Two 12-in. four-way faced Valves, by Cockey.
For further information, &c., apply to the undersigned.
R. MORLAND, Engineer.

MANCHESTER CORPORATION CONSOLIDATED STOCK.

THE Corporation of Manchester are prepared to receive TENDERS for an issue of this STOCK to an extent of £250,000.
The Manchester Corporation Consolidated Stock is by Act of Parliament (35 and 36 Vict., cap. 31) made a "charge upon the City Rate, and all landed and other property vested in or belonging to the Corporation, or which may be acquired by them."
The City Rate is not limited in amount, and the security for this Stock is, therefore, not only the whole of the property vested in or belonging to the Corporation, including the Gas and Water-Works properties, but in fact the whole of the property within the City of Manchester, the rateable annual value of which now exceeds 2¾ millions sterling.
Sealed tenders, addressed to "The Consolidated Stock Sub-Committee, Town Hall, Manchester," and endorsed "Tender for Stock," for sums divisible by ten, but not being in any case less than £50, must be delivered on or before four o'clock p.m. on Wednesday, the 5th of November next, and must state the amount required, and the premium which will be given. The Stock will be issued free of all charges and expenses, and will carry interest, payable half yearly, at the rate of 4 per cent. per annum.
Interest on the total amount of the Stock (calculated from the date or dates of payment) will be payable on June 24, 1880.
The Finance Committee have decided to fix the minimum price of the new issue at £104 10s. on every £100 of stock, below which no tender will be accepted.
Payment will be required to be made to the City Treasurer as follows:—One half of the allotment on the 19th of November, and the other half on the 5th of December next. Persons whose tenders are accepted can, if they so desire, pay the whole amount in full on the first-named or any subsequent date up to the 5th of December, and interest at 4 per cent. will be allowed.
In the event of the receipt of tenders for a larger amount of Stock than that proposed to be issued at or above the minimum price, the tenders at the lowest price accepted will be subject to a *pro rata* diminution.
Printed forms of tender can be obtained at the Office of the Registrar of Stock, at the Town Hall, but no specific form is absolutely required.

By order,
JOS. HERON, Town Clerk.
Town Hall, Manchester, Oct. 17, 1879.

Now ready, Second Edition, price 7s., by post 7s. 3d., the

GAS MANAGER'S HANDBOOK.

By THOMAS NEWBIGGING, M.I.C.E.

Orders to be sent to

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WANTED, by Samuel Thompson & Co., Colliery Office, Lancaster, APPLICATION for PRICES from Gas Managers who are prepared to receive Tenders for GAS COAL or CANNEL.

John Leigh, Esq., M.R.C.S., F.C.S., &c., &c., in his analytical report of S. T. & Co.'s Coal, says: "It is remarkable for its purity, I have scarcely ever examined a Coal containing so small a quantity of ash and when Cannel of the best description is scarce, it may well replace this material."

SWANWICK CANNEL.

Illuminating power, 24 candles. Good Coke, 11¼ cwt. to the ton.

For analysis, prices, and references, apply to

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A. FAIRLIE WILSON,

CONSULTING GAS ENGINEER,

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Reports and Valuations in the Management, Construction, and Structural Value of Gas-Works.

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Makers of THE IMPROVED DRY GAS-METERS, THE PATENT WET GAS-METERS, Special Meters for Public Lighting, STATION-METERS, Governors, &c.

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Formerly also (Walter Ford) at Gray's Inn Road.

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THE Tawd Vale Colliery Company, Limited, are prepared to Contract for the Supply of their superior Arley and other GAS COALS, and to send samples to the order of Gas Engineers and others, or complete analysis on application. Shipped at Liverpool, Preston, Fleetwood, Garston, or Birkenhead.

Mr. James Paterson, C.E., F.G.S., in his analysis of T. V. Arley Coal, says: "Some parts merge into a semi-Cannel; Gas per ton, 10,300 cubic feet; illuminating power, 16·96 candles; coke of high quality, 1431 lbs. per ton."

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W. C. HOLMES & Co.,

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GAS AND WATER-WORKS,

HUDDERSFIELD.

REFERENCES TO UPWARDS OF 400 WORKS.

Now ready, price 6d. and 1s.

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SOFTENING AND PURIFICATION

OF

WATER

ON AN IMPROVED SYSTEM.

PART I. explains the application of the system to large or small supplies for Private Mansions, Schools, Colleges, Asylums, Hospitals, Public Institutions, &c. Price 6d.

PART II. treats of the application of the system to large supplies for Water-Works and for Manufacturing Purposes, Paper Mills, Breweries, Bleach Works, the Prevention of Incrustation in Steam Boilers, stationary or locomotive, &c. It also contains extracts from Tables of Analyses, and Notes on Water Supply, specially useful for reference in connection with the question of Water Softening and Purification. Price 1s.

F. H. ATKINS & CO., ENGINEERS,

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JOHN ROMANS, C.E., F.G.S.E.,

CONSULTING GAS ENGINEER

AND

CANNEL COAL FACTOR,

30, St. Andrew Square, EDINBURGH.

Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.

GAS-WORKS TAKEN ON LEASE.

MR. ROMANS has for upwards of 30 years been practically engaged in the Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTERMIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

ANALYSIS AND PRICES FORWARDED ON APPLICATION.

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STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS LUMPS, TILES, and every description of FIRE-BRICK.

Proprietors of

BEST GLASS-HOUSE POT and CRUCIBLE CLAYS.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

ASBESTOS,

INDESTRUCTIBLE FUEL FOR GAS-FIRES.

REDUCTION IN PRICES.

Apply for Price List and Samples to the Original Manufacturer,

THOS. REYNOLDS,

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E. & W. H. HALEY,

IRONFOUNDERS & MAKERS OF

CAST-IRON PIPES

FOR

GAS, WATER, & STEAM.

LISTER HILLS FOUNDRY,

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S. PONTIFEX & CO.,

GAS AND WATER ENGINEERS,

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Supply and Erect Street Lamp Columns, together with Head Irons and Lanterns, as well as all the other fittings connected therewith.

S. P. & Co. also contract with Gas, Railway, and other Companies, Local Boards, and Vestries, for the maintenance and repair of Lamps and Fittings.

M. DAVIS & CO., 27, Wellclose Square, LONDON, E.,

COMMERCIAL GLASS WORKS.

BEST OPAL SHEET GLASS, IN CASES OF 200 FEET.

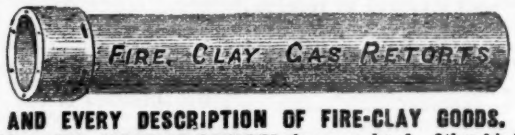
150 Y	7d. per foot.	26 Y	11d. per foot.
21 Y	9d. ,,	32 Y	1s. 3d. ,,

Enamelled Sheet Glass, Flint and Opal, 1s. 2d. Coloured Glass and Opal, 1s. 6d. to 2s. 6d. per foot.

GAS GLASSES. OF ALL DESCRIPTIONS ON HAND; SPECIAL PRICES FOR QUANTITIES

JOHN HALL AND CO., STOURBRIDGE,

Manufacturers of FIRE-BRICKS, LUMPS, TILES,



AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

LONDONDERRY GAS COALS

DIRECT FROM THE

MARQUESS OF LONDONDERRY'S COLLIERIES.

COUNTY OF DURHAM.

For Prices and Particulars, apply to

MR. S. J. DITCHFIELD,

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BUILDERS AND CONTRACTORS

FOR THE ERECTION AND REBUILDING OF GAS AND WATER WORKS,

RETORT-SETTING—A SPÉCIALITÉ.

ROBUS'S IMPROVED RETORT-SETTINGS, guaranteed to Carbonize a large amount of Coal with a small per cent. of Fuel.

ESTIMATES GIVEN FOR MAIN-LAYING.

N.B.—All kinds of Fire Goods and Gas Apparatus supplied on the shortest notice.

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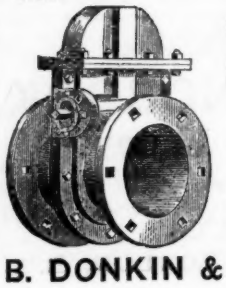
IMPROVED GAS-VALVES

TRADE MARK.

WITH WROUGHT-IRON PINIONS.



These Valves are proved on both sides to 30 lbs. on the square inch before leaving the works, and are kept in stock.

In ordering Valves, please state whether required for under or above ground, and if to be with flanges or spigots and sockets cast on, or with separate spigot and socket pieces.

Also Sole Makers of

J. BEALE'S NEW PATENT GAS EXHAUSTERS,

and Makers of

STEAM-ENGINES FOR DRIVING GAS EXHAUSTERS,

VALVES FOR AMMONIACAL LIQUOR,

IMPROVED BRIDGE VALVES FOR REGULATING THE SEAL IN HYDRAULIC MAINS,

BYE-PASS VALVES, SCREW WATER-VALVES, &c.

B. DONKIN & Co., BERMONDSEY, LONDON, S.E.

STREET-LIGHTING IMPROVEMENTS.

BRAY'S

PATENT LANTERNS & FLAT-FLAME BURNERS

Of 30 to 200 CANDLES POWER.

This Apparatus has the following merits, viz.:—

The Burners are of the Flat-Flame type, which is the only practicable type for Street-Lighting purposes.

Their lighting power is greatly in excess of Flat-Flame Burners of any other make, and the up and the down light being taken into account it is in excess of that yielded by any Burners, Flat-Flame or otherwise.

The flame in the lantern is remarkable for its steadiness, whiteness, and brilliancy.

The lantern is storm proof, its efficiency not being materially affected in a gale of wind.

It is practically shadowless, though the top light is allowed to pass freely to the upper parts of buildings, instead of being reflected, in the main, round the base of the lamp, as in some systems.

These Lamps were first exhibited in connection with the Leeds Gas Exhibition, in front of the Town Hall, in conjunction with all the improved systems of Street Lighting now before the public, when the opinions expressed by Gas Engineers and the Public were that this apparatus yielded more light and diffused it better than the other systems there tried. Since this Exhibition they have been improved in several important features, the principal of these being an arrangement whereby the flame is kept in a state of efficiency in the stormiest weather.

So long as we could see any desirable improvement to be effected, we have avoided, as far as possible, sending out our lanterns, or making any public announcement regarding them. We now feel convinced that our apparatus is nearer perfection than any in the market, and offer it with complete confidence.

Price and Particulars on application to

GEO. BRAY & CO.,

LAMP AND "ENAMEL" BURNER MANUFACTURERS,

LEEDS.

CAUTION.

The "Journal of Gas Lighting," of the 21st of October, having advertised for Sale

£4000 of First Mortgage Debentures in the English Company of the Buenos Ayres Gas Company, Limited,

Notice is hereby given that Holders of the Debentures referred to will have no resort to the assets of the Buenos Ayres Gas Company represented by

LOUIS WILDE,

42, SOUTH JOHN STREET,

LIVERPOOL.

HONOURABLE MENTION,

J. E. WILLIAMS & CO.,

PARIS EXHIBITION, 1878.

SOLE MANUFACTURERS OF THE

SPECIAL METALLIC OXIDE PAINT,

VICTORIA PAINT WORKS, COLLYHURST, MANCHESTER.

LAMBERT BROTHERS, WALSALL.

ALPHA TUBE & FITTING WORKS

Manufacturers of W. J. WARNER'S PATENT MARKET GAS STAND-PIPE.

Now ready, GAS CHANDELIER BOOK (Reduced Prices), 7s. 6d.

CANNEL COAL,

Yielding 11,250 cubic feet of 22·50 sperm candle gas per ton; 1520 lbs. of coke per ton.

Present Price, 16s. per Ton at Pit's Mouth.

ALSO

CANNEL NUTS (same Mine),

Yielding 9875 cubic feet of 18·25 sperm candle gas per ton; 1500 lbs. of coke per ton.

Present Price, 9s. per Ton at Pit's Mouth.

Any Quantity supplied at once, or by Time Contract.

THE DUKINFIELD COLLIERY COMPANY, DUKINFIELD, CHESHIRE.

ALDER AND MACKAY,

MANUFACTURERS OF

IMPROVED WET AND DRY GAS-METERS

IN CAST-IRON AND TIN CASES OF THE HIGHEST EXCELLENCE.

Original Manufacturers of Dry Meters in Cast-Iron Cases.

STATION-METERS, EXPERIMENTAL-METERS, PHOTOMETERS, & PRESSURE-GAUGES, &c.

GRANGE WORKS, EDINBURGH.

IMPROVED
COMPENSATING GAS-METER.
HUNT'S PATENT.

This Meter supplies a want long felt, by putting an end to the loss sustained by Gas Companies through the overworking of their Meters.

These Meters can now be supplied in either TIN-PLATE or CAST-IRON CASES, and OLD METERS converted to this plan. GAS COMPANIES and CORPORATIONS will find it to THEIR ADVANTAGE to adopt these Meters.

EXTRACTS FROM REPORTS.

"I am able to report that the Meters have given in each test most satisfactory results."—*Mr. H. Sporne, City of London Meter Inspector.*

"I consider the arrangement is a great improvement upon the Meters in present general use."—*Mr. T. Jackson, Meter Inspector, Birmingham.*

"I would observe from the results of my testings that the Meters are a great improvement on the ordinary Wet Meters in general use."—*Mr. H. Airey, Meter Inspector to the Metropolitan Board of Works.*

COPIES OF REPORTS SENT ON APPLICATION.

MANUFACTURED BY

JOHN BENT & SON,

WET AND DRY GAS-METER AND GAS APPARATUS MANUFACTURERS,

BELL BARN ROAD, BIRMINGHAM.

Established 1830.

NOTICE.—Notwithstanding a number of statements which have been repeated in the public journals, that burners by other makers have surpassed these results, the reports of comparative experiments from which the subjoined extracts have been copied conclusively prove that the **"Sugg" Burners give over 30 per cent. of Illuminating Power more than can be obtained from any other burners with the like quantity of gas.**

WILLIAM SUGG'S IMPROVED SYSTEM OF STREET LIGHTING.

Results obtained from WILLIAM SUGG'S large Argands for Street Lighting, by Mr. William King, Engineer to the Liverpool United Gas Company:—

ARGAND BURNER, WITH TWO CONCENTRIC FLAMES.
Consumption per hour. 22·2 ft.
Illuminating power . 103·7 candles,
Or 4·67 candles per foot of gas.
ARGAND BURNER, WITH THREE CONCENTRIC FLAMES.
Consumption per hour. 40·8 ft.
Illuminating power . 208·8 candles,
Or 5·12 candles per foot of gas.
22·7-*candle Gas was used in the above Experiments.*

"The light exhibited last night (SUGG'S 200-candle burner and lantern) was equal to 360 candles—more than double that given by the old lamps, while the consumption of gas was exactly the same—40 feet per hour." — *Glasgow Herald*, April 25, 1879.

"For all practical purposes no greater illumination than is hereby supplied could be desired." — *Vide Daily News*, Jan. 13, 1879.

NEW (REGISTERED) GLOBE PATTERN LANTERN, For London Argand Burners of 30, 50, 100, 200, and 400-Candle Power.

This lantern is glazed with opal reflecting panes and clear glass, as shown, thus securing an entire absence of shadow, and is fitted with the new self-ventilating top (registered), ensuring perfect steadiness of flame, even in the heaviest gale of wind.

Results obtained in Illuminating Power from WILLIAM SUGG'S 200-candle Burners with Cannel and Common Gas:-

Variety of Gas.	Cubic Feet of Gas burned per Hour.	Illuminating Power in Sperm Candles burning 120 Grains per Hour.	Number of Candles to which every Cubic Foot of Gas burned is equivalent.
Common 16-candle	53·4	228	4·25
Cannel 19-candle	47·3	252	4·76

Joint experiment by—

CHARLES HEISCH, F.C.S., Superintending Gas Examiner to the Corporation of London, late Professor of Chemistry at the Middlesex Hospital.

T. N. KIRKHAM, M.I.C.E., F.C.S.

C. MEYMOTT TIDY, M.A., M.B., Professor of Chemistry and of Forensic Medicine at the London Hospital, Medical Officer of Health for Islington, and late Deputy Medical Officer of Health for the City of London.

Mr. J. R. FRITH, Engineer of the Runcorn Gas-Works, Experimenting with a Sugg's Argand with three concentric rings, obtained an illuminating power of 220·5 candles, with a consumption of 45 cubic feet of 21-candle gas, or 4·9 candles per foot.

"SUGG'S 200-candle burner, with 42·09 feet of 20·85-candle gas, gave an illuminating power of 231·56 candles."—*Report of Mr. A. C. M'Minn, Engineer to The Gaslight and Coke Company, Kensal Green Station.*

"The real modern Aladdin's magician is Mr. Sugg, who, by means of his improved burner, gives us 'new lamps for old ones.' See the Waterloo Road & Waterloo Place *passim*. '*Osi sic omnia!*' If all gas-light were like these, who would ask for Edison and electricity?"—*Vide Punch*, Feb. 15, 1879.

"The perfection of street gas lighting."—*Vide Times*, Feb. 1, 1879.

PRICES AND PARTICULARS ON APPLICATION TO

WILLIAM SUGG,
GAS ENGINEER,
VINCENT WORKS, WESTMINSTER, S.W.

F. & C. OSLER,

45, OXFORD STREET, LONDON, W.

MANUFACTORY AND SHOW-ROOMS:

BROAD STREET, BIRMINGHAM.

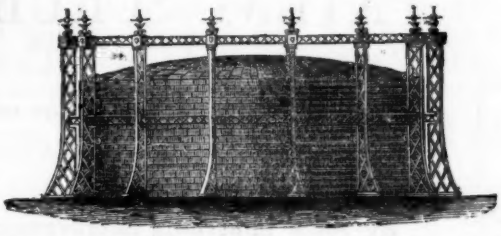
ESTABLISHED 1807.

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,

WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.

TABLE GLASS OF ALL KINDS.

CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.



THE HORSELEY COMPANY.

LIMITED,

TIPTON, STAFFORDSHIRE.

LONDON OFFICE:

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GAS ENGINEERS, IRONFOUNDERS, &c.,

MANUFACTURERS OF

GASHOLDERS, WROUGHT AND CAST IRON TANKS, CONDENSERS, PURIFIERS, SCRUBBERS, MAINS, RETORT-LIDS, PLAIN AND DISHED, LAMP-POSTS, PIPES,

AND ALL REQUISITES FOR EITHER

GAS OR WATER WORKS;

ALSO

MAKERS OF ROOFS, BRIDGES, &c.

S. OWENS & CO.,

WHITEFRIARS STREET, LONDON, E.C.,

HYDRAULIC ENGINEERS,

AND MANUFACTURERS OF

PUMPING MACHINERY of every Description.

SOLE LICENSEES AND MANUFACTURERS FOR GREAT BRITAIN OF

BLAKE'S PATENT STEAM-PUMPS.

More than 10,000 in use,

ESPECIALLY ADAPTED FOR USE IN GAS AND CHEMICAL WORKS, FOR PUMPING TAR, WATER, AMMONIACAL LIQUOR, ACIDS, &c.

The following are some of the prominent advantages of the BLAKE PUMP:—

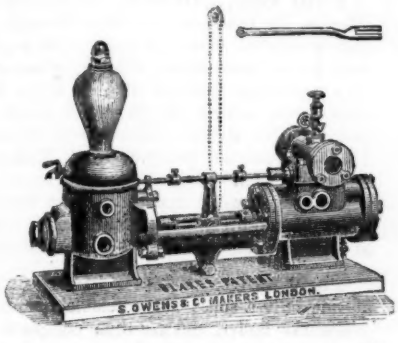
It will start at any point of stroke.

It has no dead point.

It works fast or slow, with the same certainty of action.

It is economical. Has a lead on the slide-valve.

It is compact and durable.



It is interchangeable in all its working parts.

It will deliver more water than any other pump.

It is made of best materials in the most workmanlike manner.

Can be worked at 20 strokes per hour, or 200 strokes per minute.

This Illustration represents Boiler-Feed Pumps, Sizes Nos. 1, 2, and 3, with Hand Lever for working Pump when Steam is not available.

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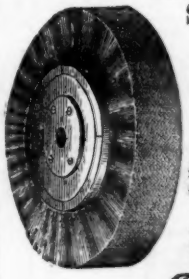
IMPROVED PATENT GAS-VALVES.

PRICED LISTS AND FULL PARTICULARS FURNISHED ON APPLICATION.

Selig, Sonnenthal & Co.,



STEEL CASTING BRUSHES

FOR HAND.

Circular Casting Brushes for Lathes and Brooms,

Admirably adapted for Cleaning Hot Castings, &c., and for general use in foundries, gas-works, chemical works, &c.

As Supplied to the Government and the leading English and Foreign Engineers, Gas-Works, &c.

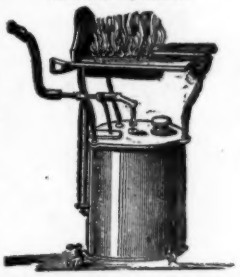
No. 1, Brush,	3in.	wire,	2	rows,	15s.	dozen.	
,, 2, ,,	3	,,	round,		22s. 6d.	,,	
,, 3, ,,	3	,,	4	rows,	22s. 6d.	,,	
,, 4, ,,	2	,,	4	,,	21s.	,,	
,, 5, ,,	3	,,	4	,,	22s. 6d.	,,	
,, 6, Broom,	12in.	block,	7in. wire,	4	rows,	72s.	per dozen.
,, 7, ,,	16	,,	7	,,	4	,,	90s. ,,
,, 8, ,,	upright,		7	,,	2	,,	48s. ,,
,, 9, ,,	12in.	block,	7	,,	10	,,	180s. ,,
,, 10, ,,	16	,,	7	,,	10	,,	228s. ,,
,, 11, ,,	12	,,	4	,,	4	,,	84s. ,,
,, 12, ,,	16	,,	4	,,	4	,,	72s. ,,
,, 13, ,,	12	,,	4	,,	10	,,	132s. ,,
,, 14, ,,	16	,,	4	,,	10	,,	180s. ,,

									each
Wheel,	6in.	dia.,	2½	wide,	1½	wire projects,	5	rows, ½ hole,	10s.
,,	8	,,	2½	,,	1½	,,	6	,, ,, ,,	12s.
,,	10	,,	3	,,	2½	,,	6	,, ,, ,,	21s.
,,	12	,,	3½	,,	3½	,,	7	,, 1 ,,	28s. 6d.
,,	14	,,	3½	,,	3½	,,	7	,, 1 ,,	39s.
,,	19	,,	4	,,	3½	,,	9	,, 1½ ,,	62s. 6d.

The "Champion" Iron Encased Forges.

Are specially suited for General Out-door Purposes, and will be found suitable to any climate.

No.	PRICES. SINGLE BLAST.	£	DOUBLE BLAST.	£
1,	9 in. bellows, to heat 1 in. sq. in 2 min.	64	6 in. bellows, to heat 1 1-8th in. sq. in 2 min.	106
2,	10 in. bellows, to heat 1½ in. sq. in 2 min.	100	10 in. bellows, to heat 2 in. sq. in 2 min.	133
3,	12 in. bellows, to heat 2 in. sq. in 2 min.	138	12 in. bellows, to heat 3 in. sq. in 2 min.	165
			14 in. bellows, to heat 3½ in. sq. in 2 min.	210



The "Champion" Iron Encased Forge,

With Vice-Drilling Frame on stand complete.

No. 10, Double Blast, 10 in. bellows, to heat 2 in. sq. in 2 min., £15.

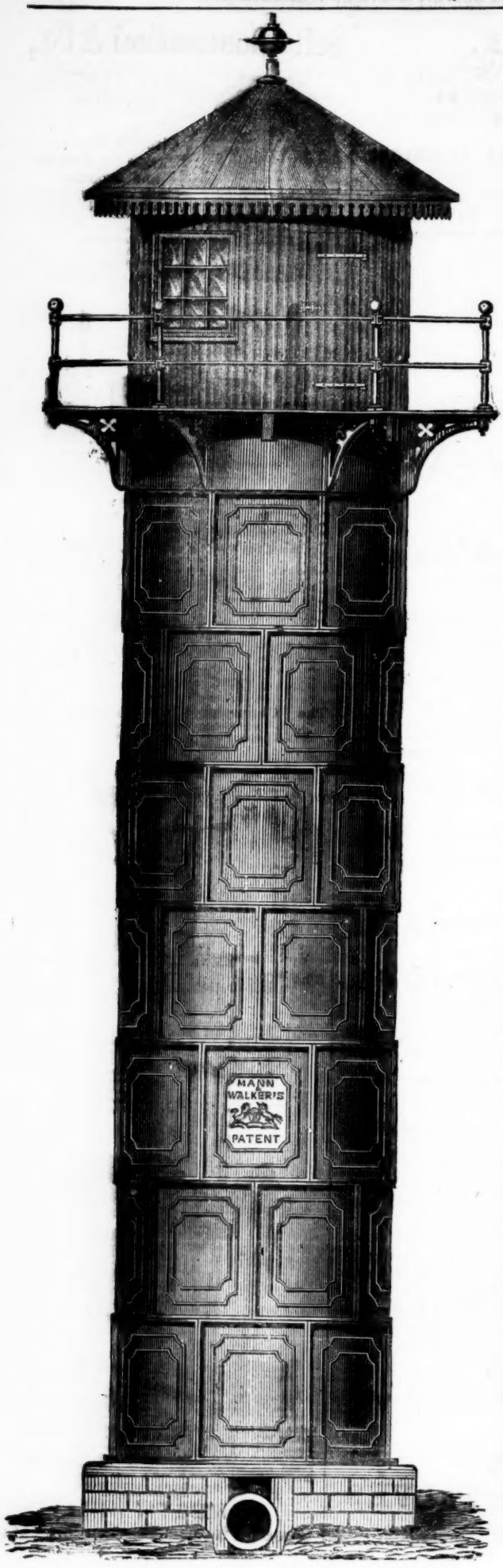
No. 11, Double Blast, 12 in. bellows, to heat 3 in. sq. in 2 min., £18.

No. 12, Double Blast, 14 in. bellows, to heat 3½ in. sq. in 2 min., £22 10s.

Sole Agents for the Lightning Screwing and Drilling Machines, Helical Pulley Blocks, Automatic Revolving Scrapers, Earth Borers, Tanite Co.'s Emery Wheels and Emery Grinders, Lathes, Genuine Morse Twist Drills, Cushman's Drill and Lathe Chucks, Patent Belt Screws, Patent Safety Belt Shippers, Casting Brushes, Shaped Diamonds, and a great variety of other Machinery always kept in stock or in progress.

LAMBETH HILL,

Queen Victoria St., London, E.C.



C. & W. WALKER,
8, FINSBURY CIRCUS,
LONDON, E.C.

MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the important results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

Fifty million cubic feet of gas per 24 hours are purified from ammonia by these Patent Scrubbers in a winter's day in the gas-works of London, where the purity of gas supply is the highest in the world, under the chemical restrictions of the Board of Trade.

Generally, wherever a high standard of purification is maintained in the chief cities and towns of the British Provinces and of Europe, these Scrubbers have become established.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, requiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

R. DEMPSTER AND SON'S

WOOD SIEVES FOR PURIFIERS,

WITH TAPER OR PARALLEL BARS,

MADE BY SPECIAL MACHINERY.

SCRUBBERS FILLED WITH BOARDS,

On our approved principle, for the extraction of Ammonia.

Prices on application. References to First-Class Engineers.

ROSE MOUNT IRON-WORKS,

ELLAND, Near HALIFAX.

London Offices: 2, SUFFOLK LANE, CANNON STREET, E.C.

GAS *v.* ELECTRIC LIGHT.

WIGHAM'S PATENT GAS-BURNERS

FOR

STREET LIGHTING, &c., WHICH REQUIRE NO GLASS CHIMNEY.

Speaking of these burners, erected on the Thames Embankment, the Governor of The Gaslight and Coke Company, at the half-yearly meeting, Aug. 15, 1879, says:

"Any gentleman who may wish to see the light, may do so at the foot of Westminster Bridge, where it is in direct contiguity with the electric light, so that he will be able to judge for himself. There is a light there that completely excels the electric light in the intensity of its illumination, and in the scope of its diffusion. The lamps on Westminster Bridge are some of Mr. Wigham's."

SOLE MANUFACTURERS:

J. EDMUNDSON & CO., GAS ENGINEERS,

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J. & J. BRADDOCK,

GLOBE METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET & DRY CONSUMERS GAS-METERS,

OF THE HIGHEST EXCELLENCE ONLY;

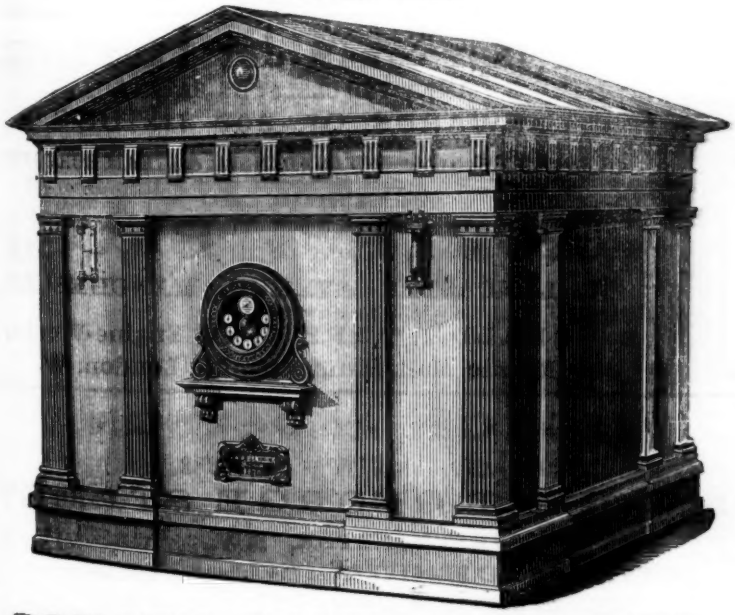
BRADDOCK'S PATENT COMPENSATING GAS-GOVERNORS;

ALSO LICENSEES AND MANUFACTURERS OF

WARNER & COWAN'S PATENT SELF-REGULATING GAS-METERS;

ROUND STATION-METERS,

ON CAST-IRON STANDS.



SQUARE STATION-METERS,

WITH PLANED JOINTS.

GOVERNORS, GAUGES, INDICATORS, MAIN COCKS, &c.

GAS COOKING APPARATUS.

Home and Foreign Orders promptly attended to.

All Sizes of CONSUMERS METERS, STATION-METERS, and GOVERNORS generally in Stock.

Orders almost invariably despatched on the day of receipt.

TERMS, &c., ON APPLICATION.

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HENRY LYON,

MECHANICAL AND CONSULTING GAS ENGINEER,

NORWOOD, NORTHENDEN ROAD,

SALE, NEAR MANCHESTER.

SANDELL AND SON,

PUBLIC ACCOUNTANTS,

2, GREAT GEORGE STREET, WESTMINSTER.

Sandell and Son having been engaged during the last 25 years in Gas Companies Accounts, either in Preparing or Investigating Statements for Parliamentary Applications, Arbitrations, and otherwise, offer with confidence their Services for similar purposes.

Mr. ROBERT DEMPSTER,

CONSULTING GAS ENGINEER,

ELLAND, near HALIFAX,

May be consulted on all matters connected with Valuations, Arbitrations, and Parliamentary Applications connected with Gas-Works. Having been engaged on extensive Arbitration Cases, which, combined with his experience in Construction and Contracting, his knowledge of Engineering and Valuations is both extensive and reliable.

W. LIDDALL,

Public Accountant,

MOORGATE STREET CHAMBERS,

GREAT SWAN ALLEY,

MOORGATE STREET, E.C.

ALFRED LASS, F.I.Accts.,

SPECIAL ACCOUNTANT FOR GAS AND WATER UNDERTAKINGS,

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Accounts Analyzed and Statistics Prepared for Parliamentary Proceedings, Arbitrations, &c.

The Forms of Account, which have been specially designed by Mr. Lass to meet the requirements of the Gas-Works Clauses Amendment Act, 1871, are now in use by many Gas Companies, Corporations, and Local Boards.

HARPER & MOORES,

PROPRIETORS OF THE

BEST STOURBRIDGE CLAYS,

STOURBRIDGE.

Manufacturers of all Descriptions of

BEST STOURBRIDGE FIRE-BRICKS, LUMPS, AND CLAY RETORTS

Of all Dimensions for Gas-Works,

GLASS-HOUSE POTS & CRUCIBLES

Established 1836.

The Highest Award was obtained by H. & M., at the Philadelphia Exhibition, 1876, for Superior Quality of Manufacture. Silver Medal, Paris, 1878.

TO MAKERS OF SULPHATE OF AMMONIA AND BUYERS OR SELLERS OF GAS LIQUOR.

F. SUTTON & CO., Norwich, are now prepared to Supply a Set of Apparatus with Standard Test Solutions for the rapid and accurate analysis of Gas Liquor, which can be used by any intelligent workman, so as to show the actual amount of Sulphate which can be got out of any sample of liquor in a few minutes, without any of the annoyance arising from saturation with acid, &c. Tables are also given, showing the quantity of acid of various strengths required for any given liquor, the accurate ounce-strength and percentage of pure ammonia, &c. Price of the set, with full direction and table (copyright), with materials sufficient for fifty analyses, £4 4s.

Post orders or cheques to be made payable to F. Sutton and Co., Manufacturing Chemists, Norwich, who also supply every description of Standard Solutions for Volumetric Analysis of Waters, Beers, Manures, &c., of guaranteed accuracy.

GAS AND WATER PIPES.

WILLIAM MACLEOD & CO.,

30, ST. ENOCH SQUARE, GLASGOW.

CAST-IRON GAS AND WATER PIPES.

DELIVERY F.O.B., GLASGOW.

Prices on application.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

198, ST. VINCENT STREET, GLASGOW.

SHOTT'S BOGHEAD.

HARTHILL CANNEL

Yields 14,920 cubic feet of 40·92-candle gas per ton.

THRASHBUSH CANNEL

12,530 cubic feet of 40·22-candle gas per ton, and 9 cwts. of good coke.

LOTHIAN'S CANNEL

Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL

Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash. This cannel is almost free from sulphur.

OLD WEMYSS CANNEL

Yields 13,320 cubic feet of 32·5-candle gas per ton.

Prices and full analyses on application at above address, or from WEDDERSPOON, FERGUSON AND CO., 21, Lime Street, LONDON, E.C.

HEBBURN MAIN GAS COAL.

This Coal is now highly approved of for gas making, and yields over 10,000 feet per ton of 15-candle gas, and about 14 cwt. coke.

For references and prices, either f. o. b. or by rail, apply to

W. RICHARDSON,

29, QUAYSIDE, NEWCASTLE-ON-TYNE.

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POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

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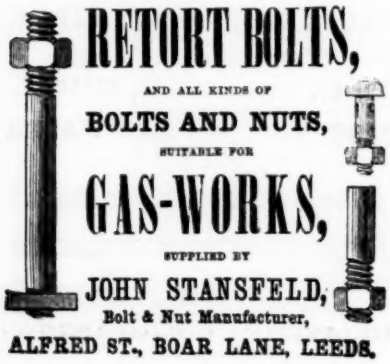

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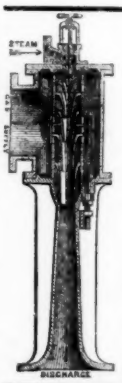

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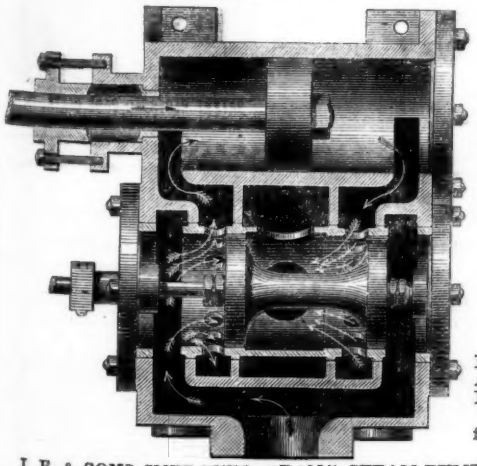

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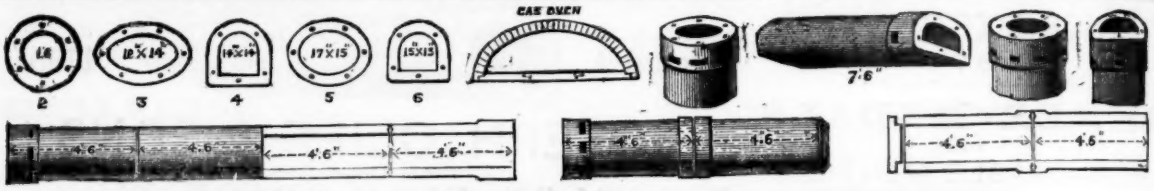

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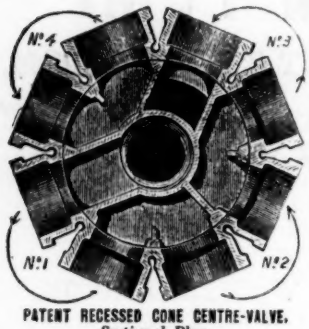

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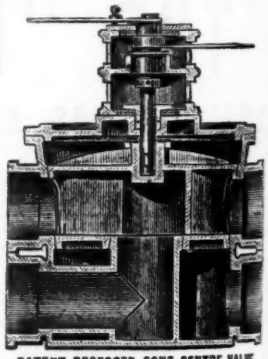

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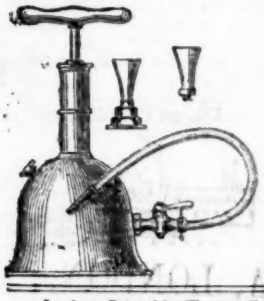

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